

SCIENCE DIGEST

JULY 1968 • 50 CENTS 100

How deep sea hunters bring 'em back alive

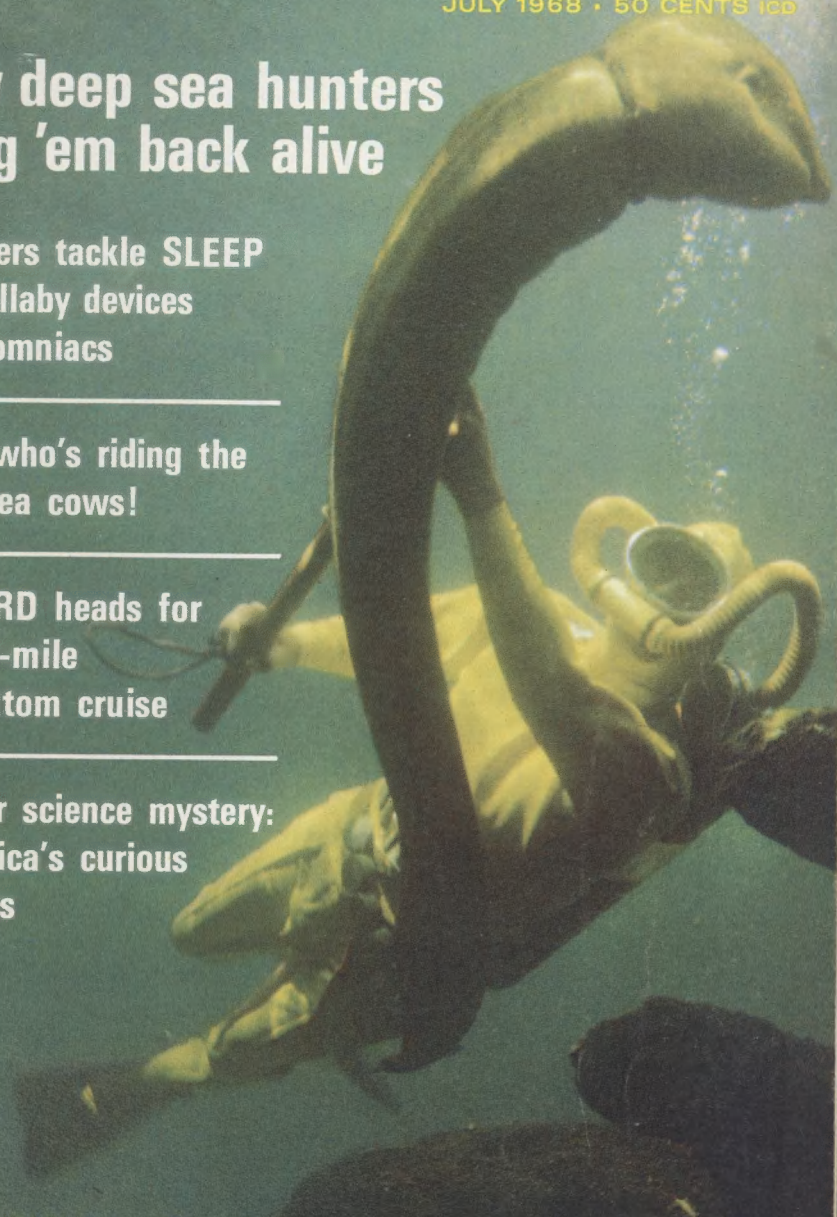
Engineers tackle SLEEP
with lullaby devices
for insomniacs

LOOK who's riding the
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Another science mystery:
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Whitney Gallery of Western Art

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* * *

In the early 1960s, amateur archaeologists found signs of human habitation in a Wyoming cave near Yellowstone Park. A team from the Whitney Gallery of Western Art, supported by the National Geographic Society and other groups,

began excavating. It was so dry that they wore gas masks for protection from the powdery dust.

Just below the surface, the team found pottery. Then, two layers below the floor, they unearthed the Indian. His body was so well-preserved in the dry air that they could see his high cheek bones, prominent jaw, long black hair and low forehead. He still wore his sheepskin garments. The archaeologists nicknamed him "Mummy Joe."

Radiocarbon dating gives the date of his interment at A.D. 678.

Stone weapon points dating back 9,000 years and evidence that Indians were smoking pipes 4,000 years ago were also discovered.

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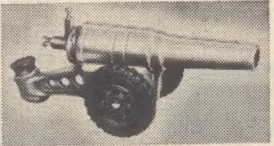


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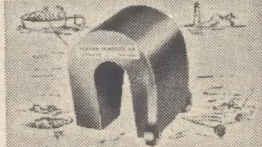
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THE NICEST THINGS happen! I was conferring with another editor the other day when one of our staff stuck his head in the door and announced: "There's a man on your phone who says *Science Digest* just won a journalism award."

I thought he was kidding. Turned out he wasn't. At this writing I've just returned from San Francisco, where I had the distinct pleasure of accepting a scroll for *Science Digest*, and an award for Morton J. Schultz, co-author of our article entitled: "Plastics: The Raw

THIS MONTH

Material for Nearly Everything." It had appeared in the August 1967 issue. Out of some 140 entries, it had taken first place in the feature division of the Second Annual Monsanto Editorial Awards for—as the parchment says—"journalistic excellence and achievement in feature writing on plastics and the plastics industry in 1967."

The presentation was made by the Monsanto Awards Chairman, Harry M. Jenkins, who is also director of U.S. Steel Corporation's Chemical Division, at the 25th Annual Western Section Conference of the Society of the Plastics Industry.

The conference seminar provided many more glimpses into the future of plastics, which you'll find in future issues. And, needless to say, we're proud of our prize. —RFD

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DIGEST®

The growth of new aquariums has created a new kind of hunter—the kind who can bring 'em back alive underwater. Our cover picture shows a diver snaring a vicious moray eel off the coast of Florida. For the story of how to catch and keep anything up to the size of a killer whale, see page 7.

Photo: Sid Latham, Photo Researchers, Inc.



JULY • 1968

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NEWS IN BRIEF

Bulletins at press time

PULSAR PUZZLE DEEPENS. Pulsars, those enigmatic objects in the sky that seem to be sending out regular radio signals, are also winking at us, astronomers now find. The flashes are not quite as regular as the radio pulses, but they still present astronomers with a major problem: How can anything generate such disciplined radio pulses which seem to be matched to light flashes of variable tempo? Astronomers are no longer giving serious consideration to the idea that the pulsars are really signals from an advanced civilization. But just what the pulsars are is the biggest mystery in the sky.

SKID CONTROL DEVICE. Ford will be offering an optional skid control device on some of its more expensive 1969 cars. According to Ford, the system, when applied to the rear wheel brakes, "aids in controlling the rear end from skidding sideways during braking on slippery road surfaces and in panic stops." But it does not shorten the stopping distance. In essence, what the system does is pump the rear wheel brakes 35 to 40 times a second to release the locked rear wheels that caused the skid.

DEAD END ON THE MOON? After U.S. Astronauts land on the moon, they may have no place else to go. The U.S. commitment to space exploration is shrinking rapidly, and the plans for missions after the Apollo astronauts land on the moon are virtually nonexistent. Already the once thriving space industry has stopped hiring and started firing. Towns which grew up because of NASA contracts are now being reduced to ghost towns. Scientist-astronauts in the manned space program are privately grumbling that things have become so slow that they may be too old to make a space mission when their turns comes up. Many already want out. Even usually cheerful NASA officials are not attempting to hide their disappointment. "There's no question but that things will be bleak in the early seventies," says Dr. Robert C. Seamans, Jr., former deputy administrator for NASA. "The question is how bleak."

RADIO STATION B.U.S. The largest network of two-way radio communication in the world will link 4,200 New York City buses with transit authority headquarters and curbside supervisors with walkie-talkies. The system will also give drivers loudspeakers so they can broadcast to passengers and to those at bus stops.

Is yours the special kind of mind that has to know...

... why wolves the world over are outlawed and labeled wanton killers. Can their cold-eyed instincts be modified? If it's true they have a vocal "language" of their own?



... what tragedy befell the ancient "People of the Jaguar" who left statues of slant-eyed, cat-mouthed children, but no record of why they vanished or where they came from?



... what weird forces created bleak deserts in Antarctica's dry valleys, where mummified seals have lain preserved for more than 2,000 years—on a continent buried under ice?



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WSD8G1

PHOENICIANS IN AMERICA? The old theory that an ancient seafaring nation, the Phoenicians, landed in America some 2,500 years ago, has been raised again. Dr. Cyrus H. Gordon of Brandeis University has retranslated a document made in Brazil in 1872. The document is supposed to be a copy of an inscription found on a rock in Parahyba. No one knows where the rock is today, but many scholars believe the whole thing was a hoax. Dr. Gordon got a clearer version of the copy that other scholars had overlooked. The inscription tells how a Phoenician vessel was caught in a storm and drifted across the Atlantic to the easternmost part of Brazil.

MORE KILLER WHALES. The once feared "wolves of the sea", killer whales, threaten to lose their reputation and become popular attractions. Two more were captured for Marine World, a newly opened amusement, research and educational complex, in San Francisco. (For details on how killer whales are captured, see page 7.)

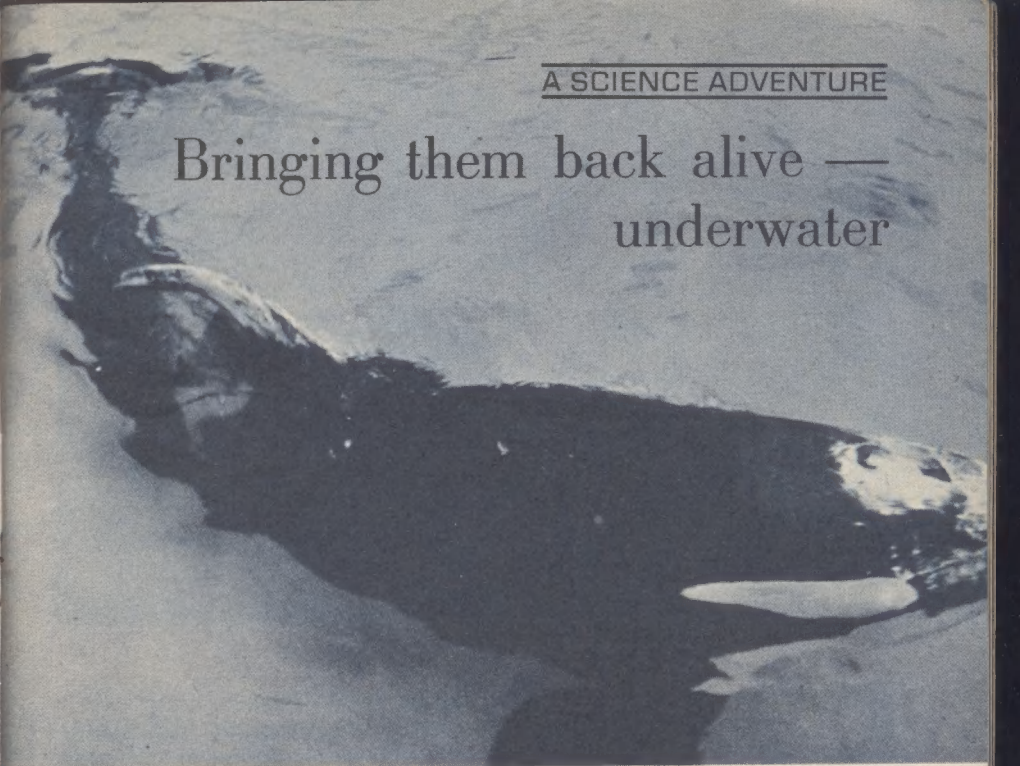
CANCER AND EMOTIONS. Dr. Jonas Salk, developer of the polio vaccine, believes that emotional factors play a part in the development and spread of cancer. He believes that the body acts indirectly through its hormone system. But he warned that no easy solutions could be expected because the body is very complex.

KEEP YOUR HEADACHE. According to psychiatrist Seymour Diamond, some people are better off having their headache. "These headaches serve as a crutch," He said "If the crutch is removed by getting at the real psychological cause of the headache, the support would be knocked out from under the patient and a more serious psychoneurosis may ensue." He also noted that physicians didn't want to get rid of all headaches. "How many girls would be going out with boys they didn't want to if we didn't have headaches."

12-MILLION-YEAR-OLD TOOL. Dr. Louis Leakey has unearthed evidence that a bone-smashing African ancestor of man used a crude stone hammer 12 million years ago. The pre-human hominid, Kenyapithecus wickeri, apparently hammered open animal skulls and bones to reach the brains and marrow. Dr. Leakey found fossil bones of animals with evidence of deliberate fractures.

HIBERNATION IMPROVES LEARNING. Yugoslav scientists believe that their experiments show that a squirrel learns better during the first few days after it has awakened from hibernation than other times.

Bringing them back alive — underwater



Bruce Frisch

Lupa, the New York Aquarium's 5,800-pound killer whale, swims contentedly around her new home at Coney Island. She is billed as the biggest whale in captivity today.

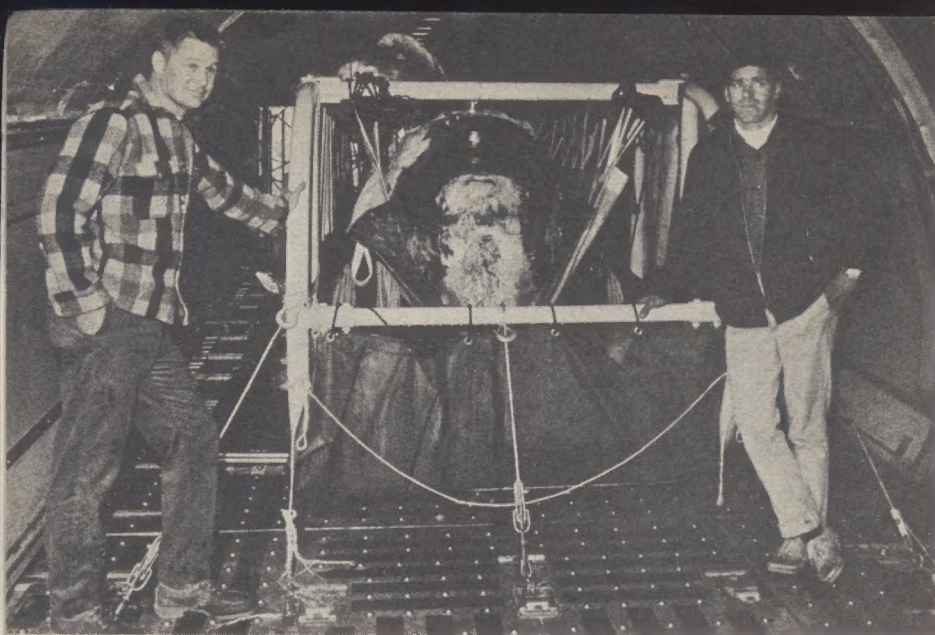
by Bruce H. Frisch

A FEW MONTHS AGO, I watched an 18-foot, 5,800-pound killer whale dangle in mid-air, suspended by a giant sling above a special New York Aquarium tank. Her broad flukes drooped out one end; her nose out the other. Like spreading wings, two huge pectoral fins stuck through holes cut for them in the fabric. The ungainly mammal resembled a fat waterbird coasting in for a landing.

Already dubbed "Lupa" ("She-wolf," because killer whales are called wolves of the sea), the creature was lowered gently toward the

water. Several tankmen in black scuba suits rode with her, keeping the top of her sling spread apart as she descended into her pool. As the sling dropped out from beneath her, the tankmen slipped a strap under her chin and prepared to lift if the air-breathing mammal started to sink. If the blowhole atop her head submerged, she'd drown.

Then, off started an odd procession under searchlights at five in the morning. Four rubber-sheathed men walked a whale to unlimber her muscles after a long jet flight from Seattle. Lupa loosened up quickly and soon was gliding unaided in stately



circles as dawn spread over Coney Island. Within a week, billed as the biggest whale in captivity, she was downing her usual ration of 150 pounds of herring a day.

His charge safely delivered, Don Goldsberry headed back to Seattle, where he and his partner, Edward Griffin, had two more whales in a tank at their Seattle Marine Aquarium.

These men are in the unique and burgeoning business of capturing and selling live denizens of the deep. With a wave of new aquariums, demand for marine life has more than tripled in the past decade. Today, you can pick up the phone and place an order for a sea lion with Sea Lions International on the West Coast. If you want a nice bottle-nose dolphin, try Stewart Gulf Porpoises in Steinhatchee, Fla. For sharks, groupers, moray eels and

other sinister whoppers of the deep, Paramount Aquariums in New York and Florida is typical of the outfits that will be happy to accommodate you—for a price.

In addition, there are professional fishermen in Hudson Bay, Newfoundland, Maine and the Gulf of Mexico who supply live sea animals as a sideline.

"Some fishermen are always open to a proposition," says Gene Heinrich of Philadelphia's Aquarium. In Maine and Newfoundland they will deliver a whale on the beach for \$1,200 to \$1,500. After that, it is your baby, and additional expenses can run high. Rich aquariums such as New York, Boston, San Francisco, Marineland of the Pacific, Vancouver, British Columbia, and the Se aquarium in Miami, send out their own collecting expeditions.

William Braker, curator at the



Bruce Frisch

Opposite page: Whale hunter Don Goldsberry (left), and curator Robert Morris stand beside Lupa in her traveling sling inside plane in which she was flown from Seattle, Wash., to New York's Kennedy Airport. Left: Crane lowers Lupa into aquarium pool. Rubber-suited men stand by if help is needed.

Shedd Aquarium of Chicago, is just back from Venezuela, where he captured five fresh-water dolphins.

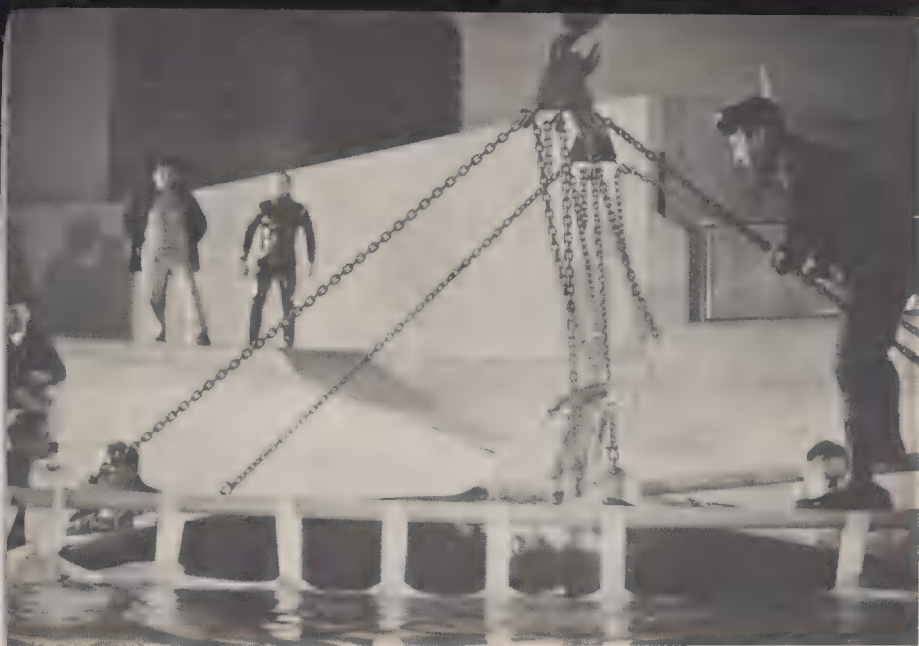
Few suppliers, however, have the successful "sea-hunter" reputation of Goldsberry and Griffin. "Marine-land of the Pacific must have spent upwards of \$100,000 trying to catch a killer whale, and failed," says Goldsberry. "The difference is what we learned from Namu." Namu was a 22½-foot-long, 4-ton bull accidentally caught in the nets of two salmon fishermen off British Columbia in 1965. Griffin, with no previous experience, had started the Seattle Marine Aquarium three years earlier, and bought the beast for \$8,000. A grim, weeks-long drama followed as he moved Namu more than 350 miles against all odds.

He surrounded the whale with a 40-foot by 60-foot pen of manila netting hung from oil drums and

topped by six feet of wire fence. A tug puffed along pulling the net with Namu swimming inside. Around this pen some 40 fellow killer whales circled tirelessly. Goldsberry, then with Tacoma Deep Sea Aquarium, was along to observe. "They were definitely trying to figure out a way to get him out," he says. "They charged the four encircling nets, but wouldn't touch them. They could have gone through them like bulls through a tennis net, but some instinct kept them from trying."

Namu was kept in a pen just outside Seattle's harbor entrance. There the big whale thrived and performed until mating season a year later, when he began charging the stainless steel nets at high speed, got tangled in some dangling ends and drowned.

Steeped in Namu-ology, Goldsberry and Griffin have since made



Bruce Frisch

Above: Aquarium attendants prepare to release partially submerged Lupa from her protective sling. Opposite page: Four aquarium men walk the killer whale, to help her unlimber her muscles after the long flight in from Seattle. Arctic killer whales like Lupa never attack people, despite their reputation. Men were in no real danger even when in the water.

some 50 expeditions after killer whales in Puget Sound. Schools of whales are spotted by the company's two float planes. A helicopter is also in on the act to hover above the target while the net is placed. A purse seiner and four professional divers handle the nets and the catch. A fishing boat loaded with food for the captives tags along.

The technique involves surrounding a pod of whales with a mile-long nylon rope net. As soon as the rope seine is positioned

around the catch, the men line it with stainless steel cable mesh. Boats and divers go over the side and—like marine cowboys—herd the whales they have chosen to keep into smaller net pens.

"I had to get into the water alone at first to show the divers it was safe," says Goldsberry. He has been pushed out of the way by the killers. They were interested in getting out, not in food, he believes. The fact is that Arctic killer whales have never been known to attack people. The Antarctic variety, which grows to 35 feet or more, may be whales of different inclination. They've been known to try and shake men off an ice floe. Whether for fun or for dinner, no one knows. They didn't succeed.

What's the price? It depends on size, condition, where the whale is going and other variables. A little



arithmetic gives a hint. Each expedition costs Goldsberry and Griffin \$25,000. On the last three they have corralled 32 whales and kept eight. To have made any kind of profit they claim they would have had to charge more than \$10,000 apiece, average.

With any large marine creature, expense is complicated by the transport problem. Lupa, for instance, could not be laid out on a platform. Her immense weight would have cracked her ribs since her body is made to be supported evenly by water. A tank would have been best, but she was too big, so a sling was chosen as the next best solution.

A battery-driven pump had to be installed to keep her wet. If she became dry, her skin would crack and stick to itself. A second reason for the pump was to keep her cool, since she has no sweat glands.

Twice during the flight, ice was taken on board to keep the recirculated water cool. On her tall dorsal fin, which would have been difficult to spray, Goldsberry smeared zinc ointment. He also put some around her blowhole where pouring water might have choked her. A separate bag enclosed the whale's tail.

All this excess baggage plus the lady's own substantial weight and her two gentlemen escorts brought her air tab to New York to \$2,500.

At Kennedy Airport in New York, she was lifted onto a flatbed trailer truck. With a flashing police car leading the way she was chauffeured to the aquarium where a crane waited to give her a Coney Island aerial ride into her new home.

Transport of other small whales is similar, but their capture is easier. Several years ago the Philadel-

phia Aquarama commissioned the fishermen of Bellevue, Newfoundland, to get some pothead whales. Bellevue is blessed with a cove having a 16-foot tide and a sandbar across the entrance. At high tide the fishermen in their dories herded three potheads into the cove. At low tide the sandbar blocked the exit and trapped the whales. Two reached Philadelphia alive, Willie, 12 feet long, and Winkie, eight feet.

A different technique has been used by the New York Aquarium to catch beluga (white) whales in Hudson Bay. The whales are simply herded into shallow water until they run aground. They are then rolled into slings, lifted aboard tank trucks and hauled to an aquarium destination.

Whales that wash ashore

Whales have accidentally run aground right on an aquarium's doorstep. One May day, a 13-year-old boy glanced out his eighth-story apartment window overlooking the Coney shore and saw a 1,300-pound pilot whale stranded on the beach one mile from the New York Aquarium. After dragging it to the aquarium, Dr. Carleton Ray, then assistant director, explained, "This species is subject to group madness. At times, they will rush to beaches, where they are almost sure to perish. If hauled back out to sea, they will head right in again."

Dr. Ray has had a long career as a "bring 'em back alive" hunter

of the deep, and is an old hand at techniques for capturing a variety of marine beasts. Not long ago he went up to St. Lawrence Island off Alaska to join a group of Eskimos on their short, five-week walrus-hunting season during the spring migration. As the Eskimos shot mothers, Dr. Ray grabbed the babies. In 10 days, he got four. Three died of pneumonia back in balmy New York.

The same method is sometimes used to capture seals. But it takes so long to reach a seal once he has been sighted on an ice floe that he has plenty of time to dive to safety. By taking a helicopter off the coast of Labrador, Dr. Ray was able, recently, to pounce on two hooded and four harp seals.

At most modern aquariums today, a major attraction is the porpoise pool, where these highly intelligent fellows cavort and entertain the public with their tricks. Securing the animals often involves as much fun as watching their antics in captivity. One device used by collectors at the Marine Studios in Marineland, Florida—for catching the spotted porpoise without injuring him—is a tail snare that is a sort of lasso-on-a-pole. The fast swimming, 10-foot character with built-in grin is elusive. As with most porpoises, his weakness is his curiosity—and a tendency to play in the bow waves of the "hunter" boat.

The tail snare consists of a long pole with a triggered device resembling ice tongs on one end. The tongs secure a loop of rope or a

*A Brooklyn boy looked out from his apartment
and saw a 1,300-pound whale stranded on the beach.*

strap. As the porpoise cavorts near the boat, the hunter holds the tongs just ahead of the animal's horizontal tail flukes and presses a trigger on the other pole end. With a snap, the rope circles the tail and the porpoise is "in the bag." Unlike most ocean dwellers, porpoises and whales drive themselves through the water with an up-and-down motion of the tail. With his tail secured to a pole and held motionless, the porpoise can't go anywhere. He's soon weary enough to be hauled aboard.

The Marine Studio's boat has a live-well, a flooded compartment open to the sea at the stern. The dolphin is led into it and a gate across the back is closed. At Marineland of the Pacific the dolphin is flipped over the side onto an air mattress on deck and covered with wet blankets to keep him cool and protect him from sunburn.

Right behind the beaches in Florida runs the Inland Waterway. This is where the Marine Studio's crew captures its bottlenosed dolphins. They watch for them playing along the shore. When they see a group follow the rising tide up one of the inlets to the waterway, they follow. Across the creek mouth they string a 100-yard-long net while the dolphins feed upstream. When the animals return on the ebbing tide, a second net is dropped behind them and the two nets are

worked together until the dolphins are caught in the meshes. The crew must get them to the surface within three minutes or they'll drown. As a rule, dolphins remain still once a hand is laid on them, but one angry bull knocked the sides out of a Marineland rowboat. Frequently, the athletic fellows leap 10 feet in the air to clear the nets and escape.

A surprise occasionally

Since nets aren't selective, some unique bonuses have come up in them at Marineland. Once, as the collecting boat's winch began to haul it in, the net, winch, boat and all began to move seaward with gathering speed, stern-first. Full speed forward on the engines changed nothing. For six hours, the entire rig was dragged all over the ocean before the net was completely hauled up. In it was a 1,200-pound manta-ray, measuring 12 feet from wing tip to wing tip. By a miracle, he was retained, beached, tied down to huge timbers, successfully trundled to the aquarium tanks on a special truck and put on exhibit. More about *him* later.

Rays are rugged even in small sizes. When a three or four-foot sting ray is hauled into a live-well occasionally, everyone stands back. One man has the hazardous job of leaning over the well edge and re-



Marineland of Florida

Above: Rare Risso's dolphin got stranded near Marineland, Fla. It wound up as an exhibit. Here it is being lowered into a special tank so it can adapt to captivity.

Below: Giant manta ray was an accidental catch. It measured 12 feet from wing tip to wing tip. It had to be hand fed, and never really adjusted to tank life.

Marineland of Florida





Hypodermic harpoon designed by Ilia Tolstoy, right, and live-well stern of collecting boat made possible the capture of large sharks and other sea animals.

Marineland of Florida



moving the poisonous barbs from its tail with a special clipper so it won't harm other specimens—including the human ones on deck.

Some big sea denizens like sailfish and tuna are never taken alive. They fight so hard they kill themselves. Experts believe that the lactic acid that builds up in their bodies during the terrific struggle interferes with respiration. The same goes for the shark, but techniques for handling him were perfected years ago.

When W. Douglas Burden and Ilia Tolstoy planned to build

Despite their ferocious appearance, sharks are delicate and difficult to keep. Here newly captured one is being given artificial respiration by being walked around tank.

Marineland of Florida



Marine Studios in the '30s, they knew they would have to have some sharks on show. At first Tolstoy tried injecting an anesthetic into the shark with a hypodermic as soon as the fish was brought alongside, but the shark's tough skin broke the needle. So Tolstoy invented a hypodermic harpoon. On penetrating the skin it triggered a compressed gas cylinder which forced ■ pistonful of anesthetic into the shark. The benumbed shark would then be dumped like a log into ■ tank on deck, or into the "sea trailer"—a pointed, open-work box towed slowly behind the boat. Sharks cannot be lifted from the water by the tail. Their internal organs are only lightly anchored, and will tear loose. Tolstoy quickly learned, instead, to transfer a shark to a tank in a canvas bag. Once in the pool, divers walk the fish around to keep a flow of water moving through its gills until it revives.

Hand-to-hand combat with eels

Those giant moray eels you see in today's aquariums are often caught by skin divers in highly unpleasant hand-to-hand combat. The moray lives in a hole in a coral reef with just its head and perhaps the front part of its body sticking out, waiting for prey to pass. The diver lures the eel out of its hole with bait, then snaps a lasso over it, holding the giant eel at pole's length. The vicious bite of a moray is paralytically poisonous. Unfortunately, the lasso can strangle an

eel or break its back, says Chicago's curator Braker. For the safety of both eel and man, he prefers a wire trap baited with dead fish or conch. Trying to pull a moray out of its hole is like getting a worm out of the ground, anyway. If the moray wraps its tail around a chunk of coral, a diver must break the rock and drag away eel, coral and all.

Fish at their doorstep

Marine Studios and Marineland of the Pacific are fortunate in having so many kinds of fish at their doorsteps. Each has its own collecting fleet. Other aquariums may occasionally accompany commercial fishermen to pick interesting local specimens from the catch. Collectors for the aquariums catch tarpon, amberjack, bonito and barracuda on rod and reel. Smaller species are gathered in wire traps or even by skin divers with hand nets.

Several aquariums have tank trucks for carrying home their catches. But only the Shedd Aquarium in Chicago has its own railroad tank car, named Nautilus. It is a converted Pullman with 16 tanks, 20 cans and pumps and filters. Once a year it is sent to Florida and every other year to the West Coast to bring back a load of about 2,000 live fish. Being inland, the Shedd must also import its salt water from the Gulf of Mexico.

Fish from overseas used to have to be brought back in tanks in the hold of a ship. Oddly, a rough sea

Moray eels are vicious and dangerous. They can either be lassoed or trapped. Trapping is safer.

that sloshed them around could make even the fish seasick.

Marine life first took to the air when Paramount Aquariums, a company that sells live fish, bought its own plane in the late '40s, and flew fish in from as far away as the Amazon. In the early '50s, airlines started accepting live fish for shipment, and today fish are flown here from such places as the Philippines, Singapore and Ceylon. The creatures are put into plastic bags full of water. Oxygen is injected into the water. The top of each bag is tied off and it is put in a carton. Four-foot sharks have been flown this way. The New York Aquarium sent a shark named Waldo and his mate, Winnie, to San Francisco, where Dr. Earl Herald of the Steinhart Aquarium wanted an East Coast sharky-looking shark for an educational TV program. A double bag, a wooden crate and the addition of chemical crystals to absorb carbon dioxide in the water were the only concessions to the sharks' size. They arrived safe and sound.

A few years later the New York Aquarium got back from California a box containing a tank holding a giant Pacific octopus. Plastic bags filled with ice were suspended in the seawater to keep it below 51° F. without diluting it. Because of his eight arms with 1,600 suction cups and 14-foot spread, the octopus was called Handy-Andy. He'd

come up with a netful of Pacific fish.

His smaller Caribbean cousins are disarmingly easy to catch. Lengths of clay pipe are lowered onto a reef, and the octopus make their homes in them. They cling to their new houses even as they are hauled into a boat.

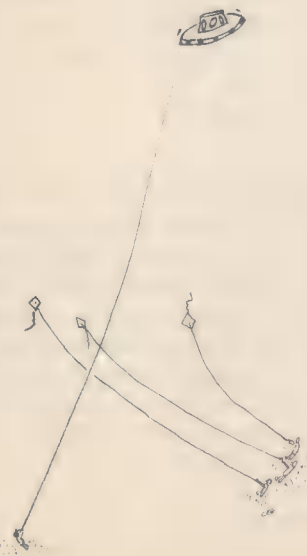
Keeping them alive

But perhaps the most intriguing collection method makes use of the remora, a sleek, one- to two-foot long fish which holds on to larger denizens (usually the side of a shark) with a suction cup on top of its head. When the host feeds, the remora drops off and rushes forward to pick up scraps. Some aquarists, it is said, tie a line around the remora's tail and release it when they spot a sea turtle they want. The remora overtakes the turtle, fastens onto the shell, and is reeled back to the boat, turtle and all.

Catching these sea beasts is half the problem. The other half—often tougher—is keeping them alive and happy in their aquarium environment. Though today's scientific knowledge permits an almost perfect duplication of their natural sea home, a vast number of "ethnic," "racial" and other problems frequently upset the balance in surprising ways.

Marineland's huge manta ray,

mentioned earlier, wouldn't eat. Finally, the scuba-diving feeders, in desperation, wedged open its two-foot mouth with timbers. One diver jammed in great handfuls of fish by thrusting them—up to his shoulder—into the gaping gullet. Worse, the ray detested captivity. He flapped around the tank bottom ceaselessly. Porpoises in the same tank, who usually sleep in 15-to-30 second “winks” near the surface, were so upset by him they wouldn't nap. Being brainy, they finally moved—after several sleepless days—to the center of the tank and resumed a normal sleep pattern. The stupid ray kept swimming his inexorable circle until he died of exhaustion.



Porpoises usually are problem-creators, due, in large part, to their genuine sense of the ridiculous. Even without a human audience, they are forever horsing around, upsetting the more dull-witted inhabitants with their nonsense. At one time, Marine Studios had a gannet visitor that used to paddle around the porpoise tank for the bits of fish he could filch at feeding time. Every now and then, surprisingly, he'd let out a croak and bounce several feet in the air without lifting a pin feather, then splash back to the surface to paddle truculently away. At the bottom of the phenomenon was a porpoise who would slither up under him and give him a snappy flip with the tail, just for kicks.

Another Marineland porpoise had the playful habit of up-ending a 300-pound trunkback turtle with his bottlenose and pushing it back and forth across the bottom just for laughs. The turtle, being a turtle, finally gave up and died.

Now and then, a porpoise overdoes it. One at Marine Studios picked on a sand shark. On every third or fourth circuit, the porpoise would playfully swish off course in passing, and jam the shark's head in the sandy bottom with his snout. This went on for weeks. But one morning, keepers found the porpoise floating on the surface with its stomach torn out. The shark was snoozing peacefully on the bottom.

Whether at sea, or in a protected tank, life in salt water is never mild.



May fly memories

May flies—simple creatures who leave the water only to mate and die—but inadvertently cause much unpleasantness wherever they go.

by Carsten Ahrens

OF THE HUNDREDS of thousands of species of insects that bless and curse this old planet, few have an existence as fabulous or fatuous . . . you decide which . . . as the may flies. Scientists have given this order a most apt name in *Ephemeroptera*; surely, for the adult, the adjective *ephemeral* fits perfectly.

As a boy growing up along Lake Erie, I remember how we dreaded "may fly time." The creatures rose from the waters of the lake by the trillions. They lived usually a day or two, a night or two, but no long-

er. During the day they rested everywhere. Grass, shrubs, trees, houses, cattle, horses . . . everything was simply covered with may flies. House painters took a vacation. So did fishermen. Fish were completely sated. Insect-eating birds and the omnivorous ones, I remember especially the ring-necks, stuffed themselves with the soft-bodied creatures until the hairlike tails or cerci protruded through their gaping beaks and waved in the breezes.

At twilight the males would take

By permission of the PENNSYLVANIA GAME NEWS © 1968 by the Pennsylvania Game Commission

to the air, and as high up and as far in any direction as one might see, there were individuals beyond counting performing their nuptial dance. It consisted of two simple movements: a short fluttering upward and a coasting back again. Up—and back; up—and back, and this went on until a female wandered into the swarm.

Dance of may flies

She was instantly seized by a male, held by his terminal claspers, and then they disappeared from the formation of dancers. If a male didn't claim a mate, he continued to execute the dance pattern until overcome by exhaustion. If he were successful in mating, death came a little sooner. The females of some species, after pairing, fall spread-eagle fashion into the water; the fertilized eggs, soon freed from the fragile abdomen, sink to the bottom, and the cycle begins once more. In other species, the female lives until she has attached the eggs, often to stones or vegetation under water.

The next time your boat is drifting lazily on some reedy lake, lean over and study the submerged life below. You'll first be aware of the variety of water plants. Then you'll begin to see various damselfly and dragonfly naiads, beetle larvae and sooner or later, may fly nymphs. They'll get your attention, for parts of their anatomy are always in action. At the anterior are two long antennae which are constantly in motion, up and

down, striking the water before them. The length of these feelers is an oddity because the insect as an adult has antennae so short that one is apt to overlook them entirely. Behind are three plummy projections, often banded. But the most noticeable organs are the quivering gills, constantly seeking oxygen. Each abdominal segment has a pair. Their movements make for conspicuousness, and so they become food for water insects, fish, frogs, turtles and wading birds. For their part, may flies are herbivorous, content with one-celled plants like algae and diatoms, or the decaying parts of higher plants.

Some species of may flies . . . and scientists have described hundreds . . . live in the water for just a few months, others, for several years. But regardless of species, each individual as an adult lives but a day, or at the most two days, out of water.

Every once in a while the growing aquatic nymph finds it is becoming too large for its old skin or exoskeleton, so the case splits down the back, and the insect, soft and vulnerable, escapes from the old shell. The new, elastic suit permits growth until it hardens. This occurs about 20 times.

Finally the day comes when the skin opens dorsally for the next to the last time, and an aerial insect crawls through. It must leave its old watery world. At this time the gills are replaced by spiracles. These are openings for breathing on either side of the thorax and abdo-

*If the weather is hot, the invasion is shorter,
but if it rains, the drowned may flies decay crops.*

men. The antennae have shortened; sex parts have developed, including clasping organs in the male; and wings have been added.

The rather triangular wings are held together and above the abdomen when the insect is at rest. They are intricately veined and occasionally spotted. The hind wings are small; in some species they are lacking.

Before leaving the water, the creature takes its final meal. The mouthparts then become vestigial, and the food canal, now that the insect will no longer eat, fills with air which aids the creature in flight. Once it makes it safely into the world above water, it undergoes one final molt . . . the cast off skins cling like may fly ghosts everywhere.

For about two weeks . . . the season was shorter if the weather remained hot . . . the invasion from the lake continued. Angling stopped. A heavy shower would rain may flies down to bury a crop like lettuce, a dead loss to the grower. The insects would crawl down between the leaves, die and decay there. Bathing beaches were deserted for the waters became thick with their countless remains. In time, the waves would deposit them in evil-smelling, slowly decaying windrows on the beaches.

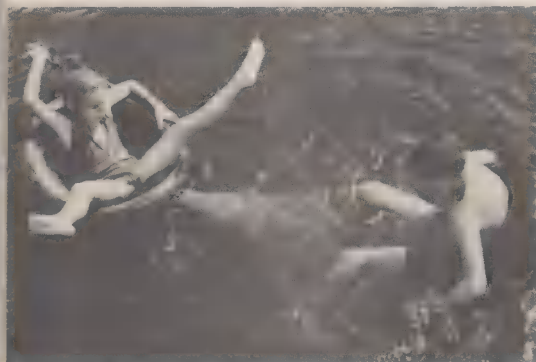
I remember an odd experience with may flies that even now after

40 years seems eerie. We had planned on a steak roast down on a sand spit that extended into the lake, forgetting that may fly time was upon us. I agreed to go early to get a fire started so that when the group arrived the coals would be ready for roasting the meat.

The fire was started, all right . . . three of them . . . but when the picnickers arrived, they retreated, bewildered and hungry. For as soon as the flames soared above the kindling, thousands of may flies rose from everywhere, were attracted to the blaze, blundered into it, causing the fire to hiss, and slowly but surely to be blanketed. We were left in an evil-smelling darkness.

At Port Clinton, Ohio, during the may fly season, the street lights used to attract such swarms of the insects that they would hang in swaying festoons, the insects clinging to each other. Below there would be a writhing mound of them under each lamp, and the vicinity would be slippery with their crushed bodies. It was inviting trouble suddenly to apply one's car brakes while driving.

The passing years have found the may flies decreasing in numbers. It has been suggested that Lake Erie has become polluted to an extent that even this meek, uncomplaining insect can no longer take it!



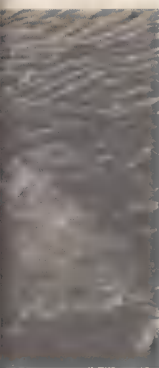
Taming the timid sea cows

FOR ANYONE who knows anything about manatees, commonly known as sea cows, the pictures above are indeed incredible.

The sea cow, a large (350 to 2,000 pounds) mammal, by nature is timid to the point of being anti-

social. Few people have ever seen the camera-shy creatures.

For the past few years, the sea-going animals have been involved in experiments conducted by Florida Atlantic University because of their insatiable appetite for water



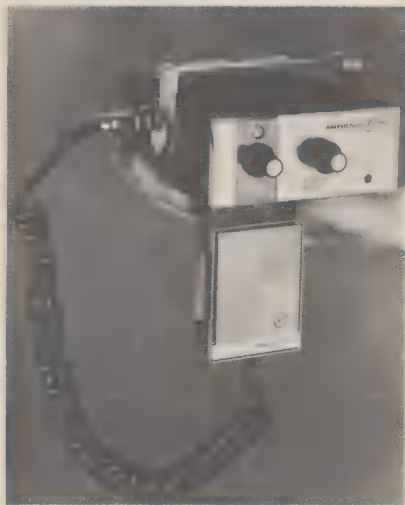
Photos by George X. Sand

vegetation. The blubbery animals can devour 100 pounds of underwater growth in one day. Moved into inland fresh water canals, the sea cows were used to eat away dense weeds clogging the waters.

And for a couple of years now, several sea cows have been engaged in an equally interesting activity. During mating season, the sea cows,

shown here, have entered a small, man-made lake near Miami, and, strangely enough, made friends with the youngsters who swim there. The kids lure the shy creatures to the surface with banana leaves, and the water play commences. These once people-shy sea cows have taken a liking to the fun and frivolity of socializing.

NEW FOR PEOPLE



World's smallest five-watt Citizens Band two-way radio sends and receives up to distance of 25 miles. Easily installed in any car, the two-way set comes from Amphenol Corp. Distributor Division, 2875 S. 25th Ave., Broadview, Illinois 60153.



Mini-racing car, the Barnard Formula VI, is seven feet long, can be set for 6 mph for children, or go 45 mph for adults. With special tuning will reach 60 mph. By Barnard Engineering Co., Trinity Trading Estate, Sittingbourne, Kent, England.

An improved version of Bell System's PICTUREPHONE, the Model II, will be tested this year at Westinghouse Electric Corp. for possible customer use in the early 1970s. Improvements in the new model, now in limited commercial use, include new television camera tube giving better picture and allowing user to zoom in or enlarge field of vision. Screen is also larger. Station set has display unit, control unit, service unit. Standard TOUCH-TONE telephone set with 12-button dial is for dialing, regular phone service.





Right: The latest in modern furniture, ■ plastic inflatable armchair, can support up to 300 pounds and comes in many colors and printed patterns. Distributed by Advertising Publicity Techniques Ltd., 356 Grays Inn Road, London W.C.1, England.

A spray adhesive that can be used on almost any kind of surface can supply either permanent or temporary bonding. It also has an extra snorkle tube applicator for close-up work. By Illinois Bronze Powder and Paint Co., Lake Zurich, Ill.



Antarctica's mysterious volcanoes

Scientists believed that the Antarctic's volcanoes were dead. But the gulls and penguins knew better, and got out before the eruption.

by William J. Perkinson

THE EXPLOSIVE ERUPTION of an "extinct" volcano that forced scientists from three nations to flee for their lives from tiny, ice-domed Deception Island late last year is one of the main reasons why geologists—and even astrophysicists—are so interested in the great ice-covered continent that surrounds the South Pole.

The eruption also helps explain why biologists are so interested in penguins and skua gulls that breed on the rim of Antarctica. Those birds—often called the dumbest in the world—had sense enough to leave their rookeries on Deception Island four hours before the trained scientists on the island felt the first earth tremor associated with the eruption.

Whether the sudden fleeing of the birds was coincidental, or whether they sensed something catastrophic was about to happen to their rookeries, is an added chapter to the mystery of why Deception Island's volcanoes erupted in

the first place.

Something seems to be happening inside the earth itself at present. And scientists are not just too sure what "those subterranean happenings" mean.

Neither do they know whether those worldwide happenings are truly connected with "the new rim of fire" that seems to be springing up around Antarctica, the last "continent" in the world to be discovered.

That is why Russian, American and other scientists are making an intensive cooperative "International Study of the Upper Mantle." The mantle of the earth is thought to extend from some twenty to several hundred miles below the surface of the earth, to the core of the earth itself.

Thus, scientists explain, the mantle is the transmission region between what is thought to be the earth's sometime turbulent liquid core and the crust or surface of the earth on which we live.

If one of the newer geophysical theories is correct, the current

worsening of the weather is but a prelude to an increase of seismic and volcanic activity. Some scientists, particularly Soviet scientists, believe disturbances in and over the earth are linked to extremely long-range sunspot cycles of hundreds, thousands and perhaps millions of years.

Antarctica would seem to be a good place to detect any unusual movements in the earth's crust, scientists say, because it is one of the most seismically quiet areas of the earth.

In fact, they add, that while Antarctica is an ideal place for detecting earth movements caused by earthquakes and underground thermonuclear tests thousands of miles away from the ice cap, their instruments have never detected an earthquake originating beneath the South Polar ice cap itself.

Yet, they note, within the past year and a half, two new active volcanoes have been discovered around the rim of Antarctica. One of the volcanoes is on the side of the South Pole closest to South America. The other new active volcano is on the rim of the continent closest to Australia and New Zealand.

Why the South Polar volcanoes are suddenly becoming active while the ice-depressed continent is still seismically quiet is a matter that causes great puzzlement.

The most pat answer—but not necessarily the right one—they say, is that perhaps the great ice cap that has depressed the original crust of the earth to more than 2,800 feet below sea level, according to contemporary theory, acts as a damper or shock absorber for earthquakes that may occur at the bottom of the world.

Minor “ice quakes” have been registered on seismographs, the geologists add, but these are thought to be due to sudden slumping of

Birds are shown fleeing Deception Island as one of the “extinct” volcanoes there suddenly erupts. Many birds fled before scientists on the island felt anything.

U.P.I.



Reprinted with permission from The Baltimore Sun, © 1967 the A. S. Abell Co., Baltimore, Md.

snow or ice into the great crevasses that zig-zag across the South Polar Plateau.

Until early last year, all textbooks, encyclopedias and scientists were quite sure that there was only one active volcano in Antarctica, or at least only "one known" such volcano.

That is Mt. Erebus, the 13,000-foot high peak on Ross Island, not too far from McMurdo Station, the main Navy base that supplies the needs of the explorers that the National Science Foundation sends to Antarctica under the U.S. Antarctic Research Program.

A second active one

Then in January of last year, New Zealand geologists reported the discovery of a second active volcano on the rim of Antarctica. That was the 8,500-foot high Mt. Melbourne, located at about latitude 74 degrees, 25 minutes south, and longitude 164 degrees, 50 minutes east.

Then came December's startling report that scientists from Argentina, Chile and Great Britain had fled Deception Island because of the eruption of an extinct volcano there.

Deception Island lies about 600 miles south of Tierra del Fuego and Cape Horn, on the southern tip of South America.

The island's geographic coordinates are 62 degrees, 57 minutes south, and 60 degrees, 38 minutes west. That means it lies about 150

miles north of the American scientific base on Anvers Island, off the coast of the Antarctic Peninsula.

Just what caused the Deception Island volcano or volcanoes to explode so rapidly that the eruption caught even trained scientists by surprise is a matter of conjecture.

The "long-range, instant diagnosis" by experts of the U.S. Geological Survey in Washington, D.C., is that one of these things may have happened. In the order of preferred theory, those "things" are:

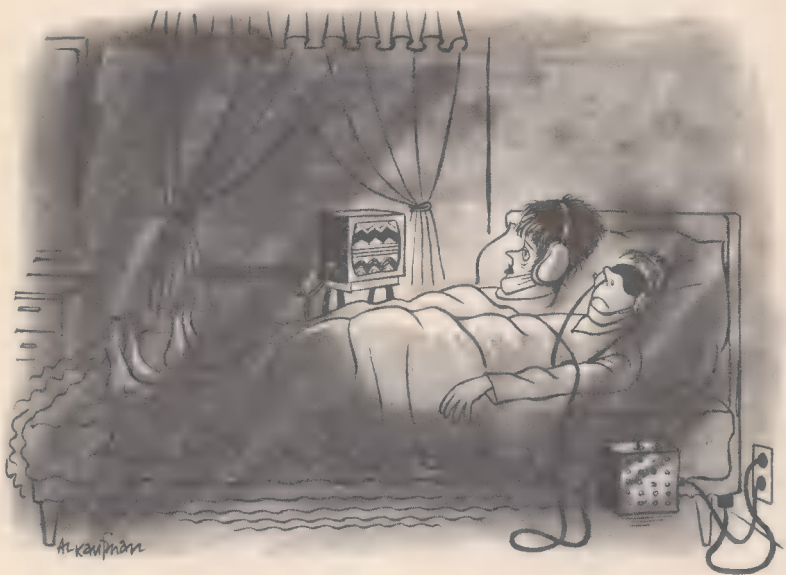
1. The harbor at Deception Island is really a drowned volcano caldera, somewhat similar to that of Crater Lake in Oregon.

Water from the lake may have seeped through the rocky lake bed over a period of years and finally enough accumulated so that it became superheated and the resulting steam built up enough pressure to spew lava over the seven-mile long and eight-mile wide island.

2. Pressure inside the earth, due to an unknown cause, may have caused the Deception Island volcano to become active, just as Kilauea in Hawaii is now "growling."

3. Possibly the earth is undergoing some kind of cyclic change that may be due to earth currents bringing up material from deep inside the mantle, or perhaps may be related to magnetic fields generated inside the sun or elsewhere in space.

No one knows for sure, the experts say. That's why scientists are interested in Antarctica and its mysterious volcanoes.



Hardware to help you sleep

Vibrating beds, ear plugs, eye masks, humming noises—they're all part of the insomniac's desperate search for one thing—sleep.

by Barbara O'Connell

"DO YOU HAVE a little thing that makes noise so you can sleep?", inquired a gray-haired, anxious-looking woman in Hamacher Schlemmer's, a New York store specializing in odd and expensive gadgets.

The salesman led her to a machine that looked like a miniature

flying saucer. "This is better than wine and martinis," he said, pushing a button in the side of the machine. It gave off a low, humming noise.

"It sounds like an air conditioner," said the woman.

"Yes, but it doesn't blow; it isn't cold," beamed the salesman.

"It's not very loud," she murmured. She left without the saucer,



Some need giant beds in order to sleep.

her brow still furrowed.

The gray-haired woman is probably one of the millions of people in the world who have trouble getting a good night's sleep, particularly in big cities. Traffic, garbage trucks grinding away, neighbors, stereo phonographs, drafty air conditioners, neon lights and a host of other modern developments that can add immensely to our comfort also can contribute heavily to our discomfort by keeping us awake. Once we do fall asleep, the same stimuli are capable of waking us up.

Not everyone suffers from sleep loss, of course. Recent research shows that there is a measurable difference between good sleepers and poor sleepers. The same conditions that disturb a poor sleeper leave a good sleeper unaffected.

But what's a light sleeper to do? Short of moving to the country, he can take barbituates or tranquilizers. Millions of Americans do. But

many others put their faith in what one expert calls "mechanical" sleep aids. In search of a good night's sleep, Americans are buying longer and wider beds, harder mattresses and fluffier pillows than ever before. Devices like the sleep sound at Hammacher Schlemmer sell well, too. When the modern insomniac retires for the night, his bed may well be more crowded with accoutrements than those of the French kings. But there's a lot of room for gadgets in the modern bed.

"A few years ago, people slept on 54-inch beds, but we don't sell many of those now," says Frank Cirigliano of Hein and Kapins, Inc., a New York firm. "Most of the beds we sell are 60 inches wide. With a 54-inch bed and two people, you get only 27 inches apiece—that's what you'd give a baby to sleep on." Hein and Kapins make custom beds for sleepers who want even more room. One of their recent orders was for a bed 85 inches wide by 74 inches long, which is about the size of the average Manhattan "efficiency" apartment bedroom.

Size is only one of the comfort factors in the modern bed. Vibrating beds shake you to sleep with a gentle motion (earlier models rocked rather violently, but the motion has been subdued). Electrical beds go up, down and even around if you're willing to pay for it. The "Aquarest" bed offered for sale a few years ago for \$1,900 consisted of a bathtub-like device full of circulating salt water in which the body floated. So restful was Aq-

Beds today are bigger and better than ever, with versatility that did not exist a few years ago.

uarest sleep that its manufacturer claimed you needed only four hours of it a night. A "womb bed" built on special order by Norman Dine's Sleep Center, East Orange, N. J., includes a bed and air conditioner inside a curtained lucite cell. So far, Dine has sold only one.

One advantage of the modern bed is its versatility. Does your spouse steal the covers? Grab them back and glide away on your king size, foam latex, slide-apart canopy bed from Norman Dine's. Do you yearn to spend all your time in bed? Purchase Dine's twin "culture bed" with a central divider containing book shelves, a built-in record player and a plastic top for eating. Do you like a soft bed while your spouse likes it hard? Get a double bed with one hard side, one soft, also from Dine's.

To go with this variety of beds, manufacturers sell spring, foam and horsehair mattresses. About the only kind of mattress they don't offer is the old feather mattress—it's considered too hot and soft for today's tastes. Hard mattresses are in vogue now, particularly for the alleviation — and prevention — of back problems. Pillows are even more varied than mattresses. The time was when one rectangular pillow sufficed, but Norman Dine's sells at least a dozen in all shapes and sizes. Some have cut-outs, others are contoured. One conceals a

speaker that lets you listen to the radio while your bedmate sleeps.

But even with the best bed and bedding, people still have trouble sleeping. For these harried souls, there's a long list of mechanical sleep aids. The undisputed king of the sleep gadget business is Norman Dine, who sells his own inventions and others in his East Orange shop. People write for the devices from all over the world. "Here's one from a soldier in Vietnam," says Dine, sifting through a pile of correspondence. "He can't sleep because there's a bright light in his face." Bright lights would seem to be the least of a soldier's problems in Vietnam, but Dine immediately dispatched him a sleep mask.

Sleep is serious business

Dine takes the sleep business seriously—he's a former insomniac—but he milks it for all the laughs he can get. The walls of the shop, a spacious area on the ground floor of Wuensch's Store in East Orange, are hung with light-hearted signs. "Your Rights in Bed," proclaims one. "No husband or wife has ever deserted or divorced our matched mattresses," says another. He sells a "Call of the Wild" horn to express mating moods, a satin sleep mask embroidered with sheep jumping over a stile and a "headwarmer"

that's a descendent of the nightcap.

Most of his devices are serious enough to poor sleepers, though. For people sensitive to noise, he sells ear plugs, a sleep noise like the one at Hammacher Schlemmer, and the "Noisefoe", a heavy, earmuff-like device that clamps on the head and looks about as comfortable to wear to bed as a space helmet. It's manufactured by the Automatic Mine Safety Appliance Company. "Who wears it?" queries Dine. "Desperate people. We get some desperate people in here. It's more uncomfortable for them to hear noise than to wear the 'Noisefoe'."

Slumber tones, cumfort grippers

Some of the devices are quite ingenious. There's a lamp with a photo-electric switch that turns off when you clap your hands, and a snore mask that's tied around the snorer's jaw. A "Slumber Tone" for babies provides a steady, comforting sound that the manufacturer claims is similar to that of the prenatal environment. A tiny air purifier is designed to be used near the bed and a "Cumfort Gripper" keeps those slippery satin comforters from sliding off the bed. A Robot Cigarette Holder lets the sleepy smoker puff away in peace while his cigarette rests safely in an ashtray.

"Most of the things we do don't create sleep; they bring about the onset of sleep," explains Dine.

Dine now has some company in the sleep center business. An enterprising Frenchwoman, Marianne

Frey, has just opened a French slumber shop called Boutique du Sommeil at 24 Avenue Pierre I de Serbie in Paris. She, too, has vibrating beds, bedding (much of it from America), ear plugs and gadgets. A French machine shows colored patterns on a screen to calm the optic nerve, perhaps more jumpy in France than here.

One noted Frenchman would certainly have appreciated Miss Frey's shop. He was author Marcel Proust, who was so afflicted by noise (his asthma forced him to sleep in the daytime) that he lined his bedroom with cork. When he traveled, he always rented the rooms on either side of his—and sometimes the one above—to avoid noisy neighbors. Another particular sleeper was Charles Dickens, who reorientated hotel beds so that his head would face north and his feet south. He was following a popular theory of the day that claimed that electromagnetic currents flowed from north to south.

Strange sleep customs persist among the famous and non-famous. Winston Churchill demanded two beds on his travels. He was a good sleeper, but only, he said, if he had two beds, one to change into when the sheets on the first became rumpled. Madame Chiang Kai-Shek always took her own sheets along when she traveled, even when she visited the White House during World War II. A San Francisco man who could only fall asleep in an open coffin is described by Gay Gaer Luce and Dr. Julius Segal in

their book, *Sleep*. Charles Kelly, who wrote *The Natural Way to Healthful Sleep* in his nineties, lulled himself asleep by breathing to the tune of "Twinkle, Twinkle, Little Star."

Is there any real value in such peculiar rituals? According to Dr. Segal, who is a psychologist with the National Institute of Mental Health, there is indeed. "Freud said that every individual has some ritual that precedes sleep," he notes. "It is highly important to us. We may not sleep without it." Such rituals, he says, may have psychological importance. Some may have a physical importance, too. The poor sleeper who takes a nightcap is not only following a ritual, but imbibing a mild depressant that may in fact help sleep. Dr. Segal mentions food, exercise and hot milk as other rituals that may have a physical effect on sleep.

"I think that parents are needlessly upset when they think that their children are postponing bedtime willfully," he adds. "Actually, many children are preparing for bed by going through some mumbo jumbo."

What of the "mumbo jumbo" of donning sleep masks, turning on the sleep sound, or sealing your ears in a "Noisefoe"? Obviously, these can be part of a ritual, but recent research indicates that such devices might help a poor sleeper fall into a deep sleep faster. There are four stages of sleep, the initial stages of which can easily be interrupted with a modest sound. Even dreams, it's

been shown, are non-controversial in these stages so as not to postpone the dreamer's shift into deeper sleep. If no disturbances occur, the sleeper slides into a stage in which it's much harder to awaken him. In these early stages, then, sleep aids which bar disturbances would seem to be of value.

At worst, the mechanical aids are psychologically helpful and physiologically harmless, which is more than can be said for barbituates. Sleep induced by these means, research makes clear, is not normal sleep. Barbituates alter the sleep pattern, generally reducing the rapid eye movement phase in which most dreaming takes place. Some day, psychologists think, pills will be tailored to the abnormalities of particular insomniacs, but that day is still distant. For the present, it's safer to use a sleep mask than a sleeping pill.

Strange sleep customs persist in some.



The great Gulf Stream drift

by Tom Nuzum

A SUBMARINE built way up in the Swiss Alps is expected to shatter endurance records for deep sea research. In September, the sub will begin drifting underwater from Florida to Newfoundland. During the entire six-week trip, while the sub will descend to 2,000 feet, it will not surface once.

No oceanographic research vessel can stay down anywhere near that long. Feats like this have only been accomplished by atomic powered subs. Advanced research craft, like the new U.S. Aluminaut, can dive 15,000 feet, but it is so thick-hulled that it can lug only enough batteries to run 80 miles.

The Swiss-made sub is about twice as big, thinner hulled and relatively light. So it will be able to carry 26 tons of batteries. Its total weight is 120 tons.

Even packing that much electricity, the sub could only travel 125 miles at its top speed of six m.p.h. But the frugal Swiss have figured out how to stretch 125 miles into 1,500 without surfacing to recharge the batteries.

Part of this trick involves navigating with a thermometer, and cooking without a burner in order to conserve electricity.

The sub was designed by Dr. Jacques Piccard, 43, who set the world diving record in 1960. He

descended 6.6 miles to the deepest part of the Pacific Ocean's floor in the bathyscaphe invented by his late father, Prof. Auguste Piccard.

The new vessel is called a "mesoscaphe" (middle depth boat). Actually, it will dive about twice as deep as atomic subs.

Piccard's craft can reach Newfoundland provided he can keep it in the center of the Gulf Stream, the warm current flowing northward from the Gulf of Mexico. But the sub is likely to lose time by drifting a mile out of the current's center each day.

That is where the thermometer comes in—to find the center of the current (where the water temperature is highest). The electric motors will run only long enough to get back in the main stream.

The mesoscaphe is scheduled to start its undersea distance attempt in September. It will have already undergone several months of testing off Palm Beach. Scientific goals of the long voyage include:

1—To drift with lights extinguished in order to get close to shy denizens of the mysterious Gulf Stream.

2—To measure the exact speed of sonar messages from an escort ship following the sub on the surface, and sent by other subs. Speed of sound increases as the water pressure increases at greater depths. But this tends to be counteracted

by the cooler temperature deep down, which slows sound waves.

"Since submarines are blind, they must navigate with their ears," says Piccard. "So more precise knowledge about the behavior of sound in the sea is needed."

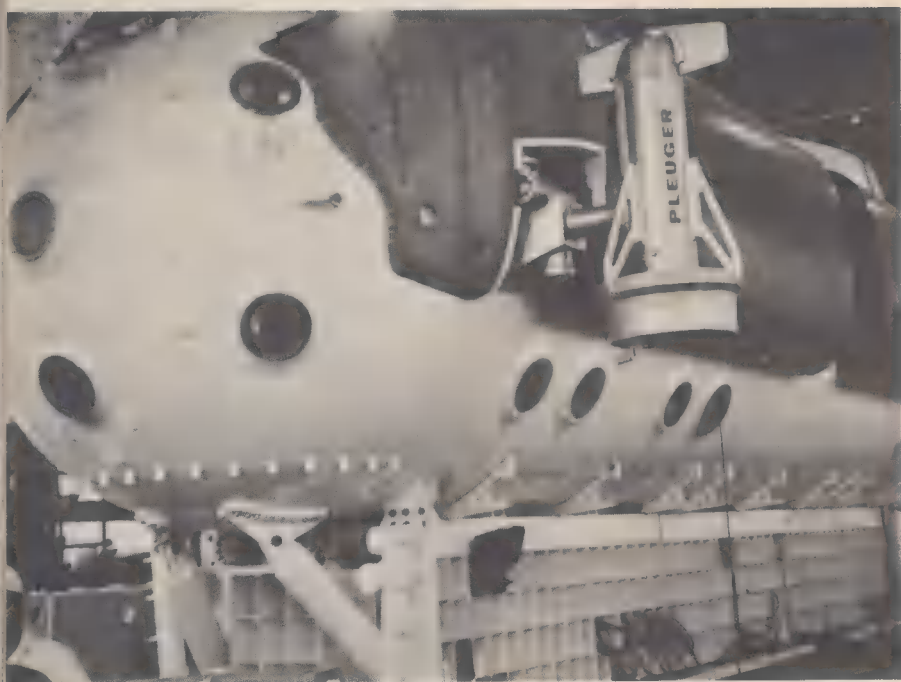
3—To chart the limits of the so called acoustic channel. It is a layer of water with the right combination of depth, temperature and salt content to make sound travel slower than at more shallow and deeper depths. This slow layer tends to trap sound waves and transmit them for hundreds of miles.

Submarines could exchange sonar messages at great distances if their skippers knew where to find the acoustic channel consistently.

Below: Jacques Piccard speaks to visitors to the Swiss plant constructing his mesoscoppe or middle-depth submarine. Right: Swiss pilot Erwin Aebersold (standing) and electrician stand at one end of the corridor running the length of the PX-15. Bunks and lab tables are spaced along the corridor like Pullman berths.

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Submarine hull sprinkled with portholes lies on honeycomb keel with compartments for batteries. Black objects are ballast tanks. A Pleuger electric motor protrudes at side.

4—To study the deep scattering layer or false bottom of the sea. This layer of water contains billions of zoo-plankton (tiny crustaceans and other animals). These minute animals are crowded so densely that they scatter and reflect sonar signals from ships trying to measure distance to the sea floor.

"Nobody knows precisely what animals compose the deep scattering layer," says Piccard, a shy-looking beanpole of a man. "Hundreds of scientists attempt to study it by dredging up samples. But we will be able to drift right in it."

Water containing the plankton will be sucked through the submarine in a pipe, observed in a plexi-glass section of pipe or poured through a faucet directly into test tubes. Samples placed in sturdy aluminum spheres will be ejected through a double hatch. After bobbing to the surface, they will be located by radar, and picked up by the escort ship.

5—To record fish noises. Unlike most submarines, this one will be able to hover at any depth in perfect silence without pumping water ballast to trim its weight repeated-

ly. The reason is that the mesoscaphé, christened the PX-15, is less compressible than water. So as it sinks, its density will increase less rapidly than the surrounding water's, until the water is dense enough to buoy up the vessel.

Four U.S. scientists will be aboard, as well as Piccard and his Swiss pilot, Erwin Aebersold, 39. Construction of the \$2 million PX-15 was financed by Grumman Aircraft, one of nine U.S. corporations developing research subs to prospect the fabulous sea resources.

Drifting to Newfoundland raises some unique problems:

Keeping abreast. The escort ship will have to steam south at two knots an hour to drift north at the same speed as the PX-15. For the surface speed of the Gulf Stream is four knots while it only flows at two knots deep down.

Cooking would burn up too much electricity. So freeze-dried food will be diluted with water preheated in Florida, and kept hot six weeks in super-insulated 50-gallon thermos jars. There will even be enough for hot showers and shaves.

Continuous night. No ray of light penetrates down 2,000 feet. Yet the six-man crew will lunch at noon, work only during "daylight" hours and sleep when it is night at the surface, "to avoid interrupting our human equilibrium," said Aebersold. Artificial sunlight will be furnished by infra-red and ultra-violet lights.

Worried wives. The disappearance of French and Israeli sub-

marines recently upset Aebersold's spouse, "until I explained why the PX-15 is much safer than military submarines," he said.

"To save weight for fuel and torpedoes, they must do without safety factors like our thick hull (1.4 inches of steel) and magnetic ballast. Our safety coefficient is 2 to 1 (meaning that the sub could dive 4,000 feet instead of 2,000 before the water pressure crushed it). The collapse depth of military subs is only 1.2 times their operational depth."

The magnetic ballast consists of six tons of iron BB shot "frozen" together in fiber glass ballast tanks by electro-magnets. Opening an electric switch breaks the magnetism and allows the shot to pour out until the sub rises. If the electric system failed, the iron ballast would pour out automatically.

Toothaches a real hazard

Toothaches, the worst hazard faced, says Aebersold: "A bad tooth would not be serious enough to justify surfacing, but it could still hurt plenty."

Claustrophobia. Piccard designed a corridor 6 feet 10 inches high running the length of the 48-foot PX-15 because he could not bear ducking his head for six weeks. "I am 6 feet 7 inches tall," he explains. "In my shoes," he adds modestly.

Barnacles. Poisonous paint was applied to keep them from growing around the 29 observation port-

holes. The ports are filled with truncated plexi-glass cones, pliable enough to seal the holes under the water pressure. Glass might leak around the edges, or shatter.

Relaxation. There will be cold thermos jars, too, for drinks. But Piccard will keep the small alcohol supply under lock and key, for a drink too many could spark a temperamental explosion when six men are confined under the threatening pressure of the sea.

If the hull collapsed, the explosion would be equivalent to a blast of TNT. The men would never know what hit them.

Dishwashing would hurt morale, and waste fresh water. So disposable plates and spoons will be used.

There are 70 searchlights, and four outboard electric motors that swivel to pull the mesoscaphe up, down, backwards or forwards. The cylindrical hull is packed with instruments connected by 12 miles of electric cable weighing two tons.

Hull—a glorified conduit

The hull was welded by a Swiss company that specializes in welding conduits to withstand the pressure of water pouring thousands of feet down mountain sides into hydro-electric generators. In fact, the hull is nothing but a glorified conduit capped at each end with a steel hemisphere.

Much of the equipment is outside the hull. The 400 batteries and the iron ballast are underneath in compartments of a fiber glass

keel shaped like a honeycomb. Sea water can enter the keel and ballast tanks freely so that they need not withstand water pressure, and can be lightly built.

Batteries are protected from salt water by oil bubbles floating on top of the water inside the battery compartments.

Wireless telephone

A wireless sonar telephone will communicate short distances to the escort ship. Liquid oxygen tanks will replenish the breathing supply. Carbon dioxide exhaled will be absorbed by lithium hydroxide, lighter than the caustic soda normally used in submarines. But this air purification system will not permit the crew to smoke.

Compressed air tanks are strapped atop the hull. To ascend, Piccard only needs to let some compressed air into fiber glass ballast tanks along the sides of the sub. The air will push some of the water out of the bottom of the tanks to lighten the PX-15.

To descend again, some of the air will be allowed to bubble out of the fiber glass tanks, which will let more water back in.

Says Piccard, "The Gulf Stream Drift Mission is only a beginning—a shakedown cruise for many, many similar scientific journeys that will follow. It opens up new horizons for the men who will play a role in the long-term adventure that is waiting just below the surface of the world's oceans."

Science Month



Lee Bolton for Natural History Magazine

Face from 20,000 B.C.

A SCULPTURED HUMAN HEAD dug out of an archaeological site in Aq Kupruk, Afghanistan, may very well be the oldest carved head in the world. Carbon dating puts the date of its creation at about 20,000 B.C.

Only two and one-half inches high and one and one-fourth inches wide, the limestone head looks something like a slightly flattened hard-boiled egg with features. Round eyes, a nose, a mouth and one ear can easily be identified. There may be a mustache and a beard, too.

In spite of the possible mustache and the beard, the finder of the head, Dr. Louis Dupree, thinks it represents a woman, because most figures of a comparable date are woman figures that were used as fertility symbols.

Carved heads from the era of the Aq Kupruk head are extremely rare because the Upper Paleolithic artist didn't bother with faces. Only two other carved heads of that age are known. They are both from Europe, and neither has been radioactively dated. Unlike the Aq Kupruk head, the European heads

are made from mammoth ivory.

The sculptor who carved the stone head probably outlined the features with a pointed tool called a burin, then deepened the relief by tapping a perforator with a hammer, Dr. Dupree suggests. When it was found, the head was surrounded by tools made of a flint-like rock.

Dr. Dupree, an anthropologist from Pennsylvania State University, led a U.S.-Afghanistan expedition to Aq Kupruk under the aus-

pices of The American Museum of Natural History. He and his associates sifted through 12 feet of Neolithic and Paleolithic dust before unearthing the head in 1965.

In carbon dating, the rate of decay of radioactive carbon in fossils or artifacts is measured. Carbon 14, the radioactive element, diminishes in measurable amounts according to its age.

The tiny head was brought to America briefly this spring, then returned to Afghanistan.

Contagious sterility

Pest control could be revolutionized by the discovery of a hormone-like substance that gives insects a contagious sterility. Treated insects transfer the sterility to the individuals with whom they mate. After the initial mating, the hormone can be passed two more times before it loses its effectiveness. Since insects mate only with their own kind, the effects are limited to a single species. A Czechoslovak chemist synthesized the hormone from a self-defensive substance secreted by various trees and plants.

Inside the pyramids

Do the Egyptian pyramids contain undiscovered chambers high inside their bulk?

Probably not, says Dr. Kurt Mendelssohn of Oxford, but a survey with cosmic rays is worth the

chance. If a cavity is found, it will undoubtedly be small, with a low passageway. All known cavities in pyramids are minute when compared with the bulk of the exterior structure. The early Saqqara pyramid has no chamber at all, the tomb being located below the ground.

The reason for the minute chambers lies partly in the Egyptians' difficulty in constructing a room inside the pyramids. The weight of the stones was so heavy that it tended to crush cavities. To solve the problem, architects kept rooms small and roofed them with stone gables or corbels, sometimes with a series of voids above the chamber.

In their homes, the Egyptians used the sturdy "Roman" arch, but they never seemed to have thought of it for pyramids.

The structure that most excites the imagination of pyramid fanciers is the "Great Pyramid" of Giza, which has a curious internal con-

struction. High within the almost 500-foot-high pyramid is a chamber with an empty granite sarcophagus that was revealed by accident in the 9th century. The suspicion lingers that other pyramids may have similar chambers.

Cosmic rays might provide the answer. Gaps in the stone could make themselves felt in the rays' absorption pattern—unless the interior construction is such as to mask or falsify the readings.

Best drink of all

The best drink is a highball—or two—before dinner, according to the Life Extension Institute of New York. A drink in the morning is a sign of alcoholism, a drink at lunch affects the afternoon's work and a

drink after dinner may lead to too many. But a pre-dinner drink that is absorbed slowly like a highball "makes life a little more cheery," claims an expert.

13,000-year-old fossil

The oldest human fossil ever found in the Western Hemisphere has turned up on a ranch in Washington State. Named "Marmes Man" for the ranch where it was found, the fossil consists of part of a skull, a vertebra, some ribs, finger and wrist bones and a leg bone. They belonged to a young pre-Indian nomad who lived between 11,500 and 13,000 years ago, making them 2,000 years older than any other human fossil found in this hemisphere. Marmes Man's bones

This charred and broken skull is part of what is believed to be the oldest human remains discovered in the Western Hemisphere. It is dated at 11,000 to 13,000 years old.

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BIPS

Above: Brian Atkinson is pictured with the machine he has invented to overcome the labor problem at his English nursery. His machine produces sheets of special paper on which seeds have been fixed at predetermined spacings ready for planting direct into seed boxes. It used to take 24 women to produce 2,000 boxes daily. With his machine, it takes only two. Above left: At Mr. Atkinson's nursery, 50,000 boxes of plants are produced each year. Left: The special paper with the seeds fixed to it is ready to be planted. It takes only seconds to plant the sheet of seeds.

are charred and the leg bone is split as if to reveal the marrow, making it possible he was eaten by his associates.

Scientists versus syntax

"Daddy, I want cornflakes this morning. Must I have porridge?"

"Yes. It has been suggested by mummy that, in view of the external coldness, the eating of porridge

by you will cause an increase in bodily temperature. Furthermore, in regard to the already-mentioned temperature considerations, your grandma-knitted gloves and wool-lining-hooded coat will have to be worn."

If scientists talked about ordinary things the way they talk about science, conversations like this would take place, according to the British publication *New Scientist*. The magazine maintains that what

makes scientists hard to understand isn't their technical terms, but their tortured syntax.

Contorted syntax doesn't matter too much at scientific meetings, where everyone present is tuned in to the same frequency, but it's a bar to understanding in popular science articles, on television and on radio. People can learn enough scientific terms to grasp a scientific presentation, but "constipated narrative" will drive them away.

Why do scientists use grotesque syntax? It's partly habit and partly the result of an effort to remain impersonal. Sometime, too, the scientist tries to make the scientific process look more mysterious than it really is, says *New Scientist*. As a result, the way scientists write and talk may discourage the bright youngster hovering between science and the humanities.

Spinning for science

A ballet dancer's eyeballs may oscillate when he's rotated rapidly in a chair, but he doesn't get dizzy. Non-dancers, on the other hand, show both reactions. How do the dancers do it? A team of Danish doctors who tested members of the Royal Danish Ballet aren't sure, but they think it has something to do with hard training. Perhaps, they say, the dancers' central nervous system is conditioned to disregard impulses arising from rotation. Fixing a particular spot with the eyes also seemed to reduce eye oscil-

lation for the conditioned dancers.

Get that dope!

Dogs may soon be used to sniff out hidden narcotics for policemen and officials of the U.S. Customs and Narcotics Bureaus. German Shepherds trained to detect dope have already turned up narcotics in a series of tests conducted in automobiles and in buildings. When the dog scents the dope, it claws excitedly at the spot where it's hidden. It takes about 90 days to train a dog to track down dope.

Dogs may soon be used to detect dope in cars and buildings in the United States. This German Shepherd from Sweden is already an expert at sniffing out the dope.

Keystone





SCIENCE DIGEST SPECIAL

Metals strike back

by Arthur S. Freese

IN 1868, elephants were hard to get, and the supply of ivory billiard balls was dwindling. Billiard ball prices rose so alarmingly that the institution of the pool hall was in peril. To meet the threat, a \$10,000 prize was offered to anyone who could find a satisfactory substitute for the ivory billiard ball.

One who sought the prize was John W. Hyatt of Newark, N.J. He didn't win, but in his attempt, he discovered the first synthetic plastic material, celluloid.

For many years plastics were a curiosity, but in the years following World War II, research developed plastics that ranged from the softness of cashmere to the strength of steel.



New metals, and new uses for old metals, are emerging from the laboratories and being put into use. Here is an aluminum arch pedestrian bridge—the first. It's in Pontiac, Mich.

Suddenly metal—the primary material responsible for advancing civilization since civilization itself began—was threatened. Metals research was pushed at a breakneck pace, and soon metals as versatile as plastics began emerging from the laboratories.

There are now stainless steels you can cut with scissors; textured steels that look like wood or leather,

and steels used for dental bridge-work; aluminum ships and armor; copper that can be made into a four-inch tube, two miles long, which accelerates an electron beam to 20 billion volts and focuses it all on a single atom; a magnesium power chain saw so light you can carry it in your hip pocket.

Over three-quarters of all known chemical elements are metals. Their



value lies in a unique combination of strength, plasticity and electrical conductivity. Many nonmetals are strong, but they tend to be brittle. Metals can be overloaded considerably because, when they are severely bent, twisted, stretched or compressed, they will deform instead of breaking. Their electrical conductivity is utilized in power transmission and electrical wiring.

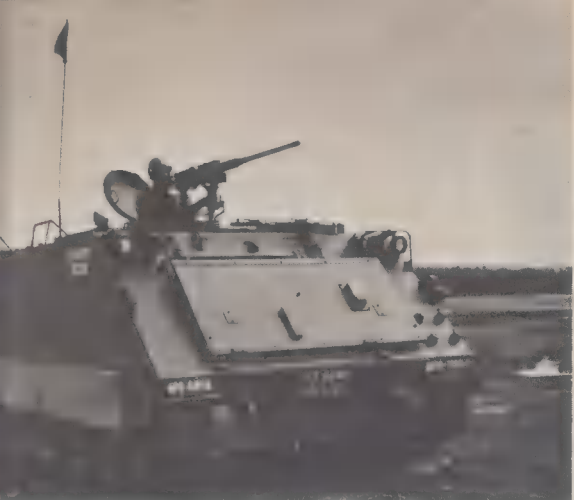
In the earth's crust, aluminum at 8.1 percent and iron at 5 percent are the most plentiful metals. Many elements we regard as common are actually far from that—zinc at 0.008 percent, copper at 0.007 percent and silver, 0.000002 percent. Fortunately, the ores of many metals become concentrated in veins and seams which mining can reach. Without this natural localization, we couldn't afford to mine many of these metals.

Iron and steel have an almost unlimited variety of applications. So useful are these two materials that their tonnage manufactured in the

United States is 10 times that of all other metals combined. If some giant magnet in the sky were to pull the iron and steel products out of our world, our civilization would collapse and we'd have no means to rebuild it.

The research and development expenditures of the steel industry today are three times that of only 10 years ago. Metals are being stimulated by the intense competition of plastics. A new era of push-button steelmaking has arrived. Computers control the production of steel from the initial order right through to delivery.

A single new furnace can produce as much steel as eight old ones. Oxygen is blasted directly into the molten metal, making steel in minutes instead of hours. This material is actually an alloy of iron and carbon, often with other elements added for special characteristics. To improve research, scientists at U. S. Steel have recently constructed one of the largest electron microscopes in existence—it



utilizes an accelerated stream of electrons which are fired, at the speed of light, through six custom-built magnetic lenses. This instrument has 10 times the power of the beam in a standard electron microscope, and permits examination of much thicker specimens. Features of a material eight-billionths of an inch in size can be seen.

Producers of metals are faced with a plastics industry capable of repeatedly developing entirely new families of synthetics, such as the recent polypropylenes which have the true look, feel and weight of wood. These new materials can reproduce furniture down to the finest details of hand carving, texture, grain patterns—even worm holes.

As radical a departure from previous materials as are the polypropylene plastics, are the latest steels such as the new superplastic stainless steel that stretches like taffy at 1700°F., and at room temperatures is twice as strong as commercial stainless. Another stainless steel, in sheets 0.012 to 0.018 inches

1. Extrusion ram of steel (left) bulged out of shape after use. Maraging steel ram (right) did not. 2. Main rotor hub of new Sikorsky helicopter is made of titanium alloy. 3. New army vehicle armored with aluminum is lighter, more mobile than steel counterparts. 4. Assembling the waveguide of the Stanford Linear Accelerator. Basic tube is fitted with copper jacket and mounted on aluminum support.

thick, is the latest flashing material for buildings—this can be cut with ordinary scissors, formed without springing back, and readily soldered. Even the lowly nail is now different—made with a spiral shank, it is lightweight and easier to drive, with less danger of splitting the wood and greater holding power.

There's also a new steel foil technology rapidly developing. Tin-coated carbon steel with a thickness of 0.002 inch or less is opening new fields of packaging materials. By itself or laminated to paper, it is tear-resistant and impermeable to vapors. The foil also comes in stainless steel, and both types can be printed, embossed or die cut. The tin-coated

foil is magnetic and in 0.002 inch thicknesses has a tensile strength of 100,000 psi. This foil is even etched to form the heating elements for ultrathin space heaters.

The Lawrence Radiation Laboratory awaits the Atomic Energy Commission's approval of its proposed linear accelerator which will use as much as 25 tons of half mil (0.0005,) one-half inch wide nickel-iron foil for as many as 1,000 mammoth magnetic cores. How much foil in this tonnage? Well, it takes 1,200 linear feet of this material to make just one pound.

Then, there's steel wire as fine as a human hair, but with a tensile strength of over 600,000 psi, one of the strongest fibers known. These have even been used in carpets to eliminate static electricity. And there are the "weathering steels"—after exposure to the elements, some 18 months in the city or double that in the country, they turn a warm

purple brown, a rich bronze, or russet color. This patina is the designer's joy, for it is both lovely and a protection against further oxidation—a permanent finish needing no attention or care. Plastics are also being applied to steels to provide color, rough or smooth finishes, woodlike grains and textured surfaces.

Electroplated coatings are being used to add the advantages of more expensive metals, such as appearance, corrosion- and wear-resistance, solderability, improved electrical properties. Scores of different steels and alloys can be used, but only about thirty are practical, and there are some 17 major types.

New steel alloys are being developed to provide better cryogenic properties or other special traits, such as increased strength and corrosion resistance. A recent breakthrough is the maraging steels, made from martensite steel by a heat or aging process. These have great strength and much promise. They are being used in the tool and die industry, aerospace and inner space (they form the twin pressure hulls of the Lockheed Deep Quest which

1. An enormous piece of nickel maraging steel will be part of an anchor installation on the tower of the Saturn 1-B.
2. All aluminum Swifts have seen much service in Vietnam.
3. Deep Quest research vessel has twin pressure hulls of maraging steel.



just went down 8,300 feet in a successful test dive).

A stainless variety of these metals is being tested for use as dental crowns and bridges, and it may produce a materials revolution in dentistry because this new alloy is stronger, lighter and less expensive than the traditional alloys now used. Its strength is so great that thinner castings can be used and the tooth not ground as much as for the conventional gold crowns.

Iron is most commonly used, but the most commonly found metal is aluminum.

Aluminum was first isolated as a tiny lump by Hans C. Oersted in 1825, but it took another 30 years for Sainte-Claire Deville to found the aluminum industry. At the Paris Exposition of 1855, bars of aluminum were exhibited alongside the crown jewels—the first the public knew of this magic metal. Napoleon III used aluminum forks and spoons for his most honored guests, the rest got only the gold or silverware; his infant played with an aluminum rattle and he presented the King of Siam with a watch chain of the metal. He even tried to get enough to

outfit his troops with aluminum armor.

The bulk of aluminum used today is in the form of alloys. Special refining procedures can produce a metal of 99.99 percent purity for use as a catalyst carrier for high octane gasoline, for jewels and for the electronics industry. Most major jewels, with the exception of diamond, are oxides or compounds of aluminum: these are synthesized today and many find their way into watches.

The two most significant characteristics of this metal for present and future technology are its lightness (one-third that of steel, copper or zinc) and its electrical conductivity (on a weight-for-weight basis, almost double that of copper). Aluminum exposed to oxygen quickly forms a thin transparent film of oxide which protects the material permanently; if this is scratched, a new coating seals off the defect.

In 1884, a 100-ounce aluminum casting was made for the Washington Monument in our capitol. The cap was first exhibited by New York City's Tiffany's alongside its best jewelry. This casting was then placed atop the monument and it is



still there. Rolls-Royce built its "Silver Ghost" car with engine parts and body of this material, and the car is still in excellent condition after over 50 years and a half million miles.

Although Napoleon III couldn't get enough aluminum to provide armor for his troops, we have it for ours. Forged aluminum armor and ballistic quality aluminum castings have reduced both the time of construction and the cost of the Army's new General Sheridan reconnaissance assault vehicle. The M113, first in a series of Army air-drop armored personnel carriers, has aluminum for both armor and hull. Recently, the Navy awarded contracts

for planes with armor plate of the same metal and a jungle boat of this material was tested out by the Army Engineer T & D Laboratories in Ft. Belvoir, Va.

Reynolds Metals Co. has set up a ballistics firing range to test the new aluminum armor plate. The gun and target buildings are connected by a buried eight-foot diameter culvert. The facility tests protection against projectiles ranging from a .22 caliber to a 20 mm round. By varying the powder charge, testers can simulate the effects of everything from point-blank range to the maximum effective range of these weapons.

The new F-111, the giant fan-jet C-5A and the new Boeing 747 are

METALS COMMONLY USED FOR STEEL ALLOYS:

ELEMENT	Amount in Alloy	Properties	Applications
Cobalt	35.00 percent	Strongly magnetic	Permanent magnets
Manganese	1.75 percent	Hard, tough, workable.	Woodcutting tools, auto axles, agricultural machinery.
Molybdenum	0.68 percent	Good heat resistance	Boiler and steam equipment
Nickel	3.50 percent	Tough	Air hammer parts, crankshafts.
Vanadium	0.18 percent	Tough, resists impacts	Locomotive parts.
Chromium-Molybdenum	0.95 0.20 percent	Resists impacts, heat and fatigue	Airplane fuselages and forgings.
Chromium-Nickel	18.00 8.00 percent	Non-corrosive	"Stainless steel"
Chromium-Vanadium	0.95 0.18 percent	Very hard and strong	Aerospace—propellor shafts, connecting rods, plane forgings.
Manganese-Molybdenum	1.30 0.30 percent	Strong, tough, resists impact and fatigue	Rock crushers, turbine parts
Tungsten-Chromium-Vanadium	18.00 4.00 1.00 percent	Retains hardness and strength at high temperatures	"High speed steel"—for high speed cutting tools.
Nickel-Chromium-Molybdenum	1.75 0.65 0.35 percent	Can withstand twisting, impacts and fatigue	Diesel engine crankshafts.
Silicon-Manganese	2.00 0.75 percent	Springiness	Springs for autos and railroad cars.

The properties of steel alloys are markedly changed by varying either the ingredients or their proportions.

almost all-aluminum. Rockets and missiles use this metal for both structure and fuel, and there are eight tons of aluminum in the Titan ICBM. A far cry from the Spanish-American War when Theodore Roosevelt's canteen, the picket pins for his troop's horses and the tent stakes used up the Army's total aluminum supply.

In the seas, too, this corrosion-resistant metal is finding daring new uses—for deep-diving submersibles and for the new all-aluminum "Sacal Borincano", a 225-foot roll-on roll-off trailer ship to carry 40 trailers. The ship utilizes 760,000 pounds of aluminum alloy and can sail in both inland waters and the oceans—with greatly reduced maintenance. It will permit freight to be loaded into trailers in the Midwest, driven aboard ship in Miami, then shipped to San Juan, Puerto Rico; all with a minimum of handling. Fishing trawlers and Navy craft, large yachts and small pleasure boats are now being built of this metal.

Aluminum has many unique uses. It is now firmly established in tournament archery where it forms the center section of the bows. A new jet train of the metal recently accelerated up to 170.8 m.p.h., near Trenton, N.J. Tests have lately shown that aluminum-cast bases for artificial dentures are more accurate than the conventional acrylic resins routinely used. This same metal is now used for house sidings and more than 90 percent of overhead transmission conductors as well as in musical instruments from xylo-

phones to organs, from pianos to huge bass drums. There are even aluminum-clad skyscrapers. An aluminum alloy cooled to 400° or more below zero F., instead of getting brittle, becomes stronger and more workable—important to cryogenics, the science of the ultracold.

Material gap is filled

But between aluminum and steel there exists a gap in engineering materials, both in weight and in strength. Titanium fills this space. Of the four major light metals (aluminum, titanium, beryllium and magnesium), it is expected to experience the greatest growth in the foreseeable future. Estimates for 1970 run nearly 70 percent higher than the 14,000 tons used in 1967. The S.S.T. will be practically an all-titanium plane and it is estimated that each one will use nearly 200 tons of the metal. An 800-plane S.S.T. market is said to require more than seven times as much titanium as was used in all 1966; Lockheed's C-5A and Boeing's 747 will take some 30 tons.

This silvery white metal weighs half as much as steel and only 60 percent more than aluminum. Titanium and its alloys have outstanding corrosion resistance and good workability—they combine the properties of stainless steel and aluminum, with definite advantages over both.

Professor Jelks Barksdale, an expert on this metal, foresees many uses once the anticipated drop in

price occurs: auto pistons, cooking utensils, tennis rackets, fishing rods, springs, textile machinery and pen points, to name a few. By using this metal in the Douglas DC-8, 1,000 pounds were saved—the equivalent of five passengers and their luggage for the life of the plane. Sikorsky replaced steel with titanium in a Marine Corps helicopter rotor hub and added 1,000 pounds lifting power to the machine. A 24-foot-long titanium tank, 8 feet in diameter and so thin it must be pressurized internally to keep it from collapsing, has been built to hold hydrogen at —423° F. for powering the space

flights of the future.

Titanium is even able to withstand the corrosive effects of salt water. The buoyancy spheres of the first deep-diving submersible, the Alvin, were redesigned from the use of aluminum to titanium. The recent America cup victory of the yacht Intrepid is said to have been due in no small part to the use of this metal for the top-third of her spar, her main boom and many of her fittings.

The third of the four major light metals is magnesium. It's one of the lightest structural metals known, but its first industrial production, in

Material	Tensile Strength psi at 70°F	Hardness DPH	Melting Point °F	Characteristics Some Applications
Type 304 Stainless Steel annealed (for comparison)	85,000	155	2600	Resists chemicals. Excellent atmosphere resistance.
Titanium (wrought)	85,000	275	3137	Light-weight; corrosion-resistant. Aerospace and Inner Space.
Columbium (melted) annealed	35,000	90	4474	Excellent strength-to-weight ratio for hypersonic space vehicles. Low neutron absorption level.
Molybdenum (sintered) stress relieved	110,000	260	4730	Good electrical, heat conductivity and corrosion-resistance. 90 percent of it is used in iron alloys.
Tantalum (melted) annealed	35,000	80	5425	The outstanding metal for corrosion-resistance and with the strength of steel. For equipment and surgical implants.
Tantalum (sintered) annealed	45,000	100	5425	
Tungsten (sintered) stress relieved	200,000	440	6170	Highest melting point of all metals, twice as heavy as iron or steel, better electrical conductivity than nickel, mercury or steel; good thermal conductivity. High strength at extreme temperatures. Varied uses—in your light bulbs (the incandescent wire), in X-ray tubes, as phonograph needles and others.
Zirconium (wrought)	64,000	190	3375	Outstanding corrosion-resistance. Important in nuclear-reactor plants and used in making steel.

With the exception of the stainless steel, added for comparison purposes, these metals represent a very special and important new group known as "refractory." Capable of standing high temperatures, radiation and corrosion, they are essential to modern technologies.

France in 1857, was for flashlight photography. Now magnesium is used in photo-engraving plates, Samsonite luggage, machine tools such as chain power saws, materials handling equipment (hand trucks or conveyor belts) and in racing car components. The military takes 15 percent of the production, but mainly for the metal's oldest use—for flares.

A recent Army contract was for magnesium batteries with their long life, low weight and safe storage for long periods, even at high temperatures. Some magnesium finds its way into aerospace. The metal is used mostly for alloying with aluminum. New magnesium-lithium alloys are among the lightest structural materials available—almost as light as plastics.

The last of the four major light metals, and the least used, is beryllium, with its high rigidity-to-weight ratio, some six times that of titanium, aluminum or steel, an excellent strength-to-weight ratio, although brittle, and a good ability to withstand high temperatures. The most important source of this metal is beryl with some 15 percent beryllium oxide—you know the clear varieties of this mineral as emerald and aquamarine. Not surprisingly, therefore, one of the drawbacks to this material is its high cost. The compounds of this metal require great care in handling, for they are poisonous. There would seem no structural applications; only uses in aerospace.

After some of these exotic aero-

space materials, it may seem a let-down to come back to plain old nickel, but this too is fighting for its place. The International Nickel Company recently developed the new stainless steel which pulls like taffy, for nickel is mainly used for alloying with other metals, giving its corrosion-resisting properties to such alloys as stainless steel and Monel. With cobalt, iron and aluminum, nickel forms Alnico, a powerful permanent magnet.

Copper ended stone age

Another old standby, copper, was one of the first metals used and marked the end of the Stone Age.

Copper's very high electrical and thermal conductivity, along with its corrosion resistance and ease of manipulation, make it a uniquely useful material. About half its production goes to the electrical industry, but from one of the oldest of the metals comes one of the newest applications. To learn more about the atom, nearly 2,000,000 pounds of O.F.H.C. (oxygen-free, high-conductivity) copper was fabricated into a 4-inch wide, 2-mile long cylinder. The inside surface is finished to better than 0.002 inch accuracy of radius and a smoothness of 0.000016 inch. This is the Stanford Linear Accelerator which has produced 20 billion electron volts, to be hurled with the speed of light against whatever target will reveal the most to the scientists.

Zinc also is an old-timer—in fact, modern electricity really began when

Alessandro Volta made the first electrical battery with alternating zinc and silver discs. Today this metal is still widely used in flashlight batteries, but it has also become essential as the silver-zinc solar battery for missiles and space vehicles. Fourth in annual world consumption, just behind steel, copper and aluminum, zinc provides most of the bright chromium-plated hardware you see on autos, appliances and other machines.

Lead maintains importance

Lead is another ancient successfully fighting back in the modern marketplace. It is an excellent sound and vibration absorbant. Hundreds of lead-asbestos vibration pads under the Pan Am Building in New York City protect those working in the structure from the rumble of commuter trains underground. In the new hydrofoil vessels, ordinary buildings and broadcasting studios, lead dampens sound and vibration. Lead-acid batteries are carrying the mail (as the power in U. S. mail trucks) and serving as personnel or fork-lift trucks inside plants, powering experimental autos and small television sets.

Besides joining the fight, in this way, against air pollution, lead has offered help to the handyman. A new product called "soldersheet" is a boon for the home handyman: made by impregnating a very porous sheet of fibrous steel with a lead-tin solder; the material can be cut with scissors, formed by hand, placed in

position on a leaking roof gutter or other metal part and then soldered in position with heat—even if you do this on the ceiling, it will not drip solder.

Obviously, it would be impossible to cover all the metals in any one article. What we have done is to tell of those longstanding ones which, threatened by newer materials, have made a comeback through the development of new forms and alloys. Many of these have even moved into totally new fields. Obviously, this can only be true of oldtimers—new metals have no past to recover from.

One of these newcomers is hafnium, which has been commercially available for only 10 years. Practically its only use is in nuclear reactors. Scandium is almost a freak—when a full pound was produced all in one place for the first time in January 1960, it made big news in the scientific world. Its commercial use is principally in radioisotope tracers for oil well drilling and in analytical work. Then there's thallium, for which many uses have been suggested but few applications found. One of the rarest of elements is tellurium, whose occurrence is comparable to gold with which it is often associated. Tellurium has found some use in thermoelectric devices and metallurgy.

The competition of the plastics and the needs of a growing aerospace technology have sparked a research and development program which is building a new world of metals, fighting to hold their own in a changing technology.

Significance of these new developments to industry, business and professions

- *Agriculture*—Metal-clad buildings will require little or no outside care, allow more flexibility in design and esthetics with use of such materials as weathering steel, lead and aluminum. Corrosion-resistant metals will reduce maintenance.

- *Automotive*—Aluminum radiators are predicted for many high-production autos in 1969. Stainless steel fans will flex to better cool engines running hotter to carry air-conditioners, anti-smog devices and high performance. Auto parts in black chrome plate will reduce glare.

- *Aviation and outer space*—Here the greatest changes will take place as technology meets demand. All-titanium and all-aluminum planes are a reality. Steel fibers, beryllium, magnesium and all the metals and alloys appearing almost daily will change these industries to an unpredictable extent.

- *Consumer goods*—Steel foil for packaging, aluminum musical instruments and beer cans, electroplated coatings, easier home repairs with metal sheets, even different batteries for everything from electric autos to tiny portable TV sets.

- *Construction*—Changes are due

here, with ultrathin space heaters, stainless steel flashing, new roofing materials of titanium-copper-zinc alloys, of lead and other metals.

- *Inner space*—The new exploration of the depths of the oceans has presented the problems of salt-water corrosion and great pressures. New ways to use aluminum, stainless steel, maraging steel, magnesium and other alloys and metals have been found.

- *Marine*—All-aluminum ships, fishing trawlers, yachts and even small pleasure boats have opened new possibilities for commercial and private sea-travel. Titanium has proven its value in sailing ships and will come in much more as the price drops. Right now, stainless steel clad hulls are being used on inland waterways.

- *Medicine*—Maraging steel is opening the way to a materials revolution in dentistry; titanium and stainless steel are being used for repairing the body.

- *Military*—Aluminum is opening the way to armored air-drop vehicles, and tanks are made lighter with it; in armor it can be used to protect pilots. Titanium and magnesium are also finding new places in war, as are the high-strength steel alloys.

Race and crime

by Flora Rheta Schreiber
and Melvin Herman

IT is the more intensive reporting of acts by Negroes that creates the see-saw in crime statistics, according to Dr. Virginia M. Love, medical director of the Lakeland Guidance Center in Pompton Lakes.

The white man who beats his wife gets psychiatric help; the Negro is prosecuted, she believes. A white housewife who has shoplifted thousands of dollars of merchandise is referred to Dr. Love's clinic and helped back to health, she says, when a Negro woman would have been sent to jail.

Dr. Love is convinced that there is much more non-appropriate dealing with black offenders than with white. She quotes Dr. Harvey Bluestone, who is developing treatment programs for prison inmates, notes that out of 18 persons he saw in death row, only one was white. The others were all Negro and Puerto Rican.

She told us a story from her childhood in the South which had greatly affected her, as the daughter

of a Negro minister. A white man had killed a black man, was found guilty and sentenced to jail—for one year. Even today, Dr. Love says, there are innumerable indications in criminal records that black life is cheap.

This point is brought into prominence by President Johnson's Commission on Law Enforcement and Administration of Justice. "From arrest records," the report reads, "probation reports and prison statistics, a portrait of the offender emerges that progressively highlights the disadvantaged character of his life. The offender at the end of the road in prison is likely to be a member of the lowest social and economic groups in the country, poorly educated and perhaps unemployed, unmarried, reared in a broken home and to have a prior criminal record." More Negroes than whites are disadvantaged.

It is the ghetto, not the race, that makes crime, we are told by psychiatrists, sociologists and criminologists. A few experts quote damning statistics, but most say, damn the statistics, because they agree with social psychologist Kenneth J. Clark, author of "The Dark Ghetto," who said, "What are generally labeled as the facts of the ghetto are not necessarily synonymous with the truth of the ghetto. In fact, there are times when one feels that 'facts' tend to obscure truth."

They also agree with Donald E. J. MacNamara, professor of correction administration at the John

Jay College of Criminal Justice, City University of New York, and past-president of the American Society of Criminology: "The seemingly higher incidence of Negro and minority group criminality reflected in official crime statistics is an artifact of racial discrimination, poverty, and ignorance of the law."

Psychiatrist Ralph E. Banay, M.D., director of the Civic Youth Center, Brooklyn, N.Y., says, "There is a definite relationship between mental health and crime, between poverty and crime, but not between race and crime. It is the ghetto, not the race, that makes crime." Dr. Banay told us, "It is the ghetto that must be treated, the ghetto that is the patient, the ghetto that calls for the skills of the newly emerging group of social psychiatrists." Further confirmation comes from Negro psychiatrist Frantz Fanon, who died at the age of 36, but not before he had written "The Wretched of the Earth", a book that has become highly influential in black communities. "There is," Fanon wrote, "a regular and important mental pathology which is the direct product of oppression." How does one "cure" this pathology? Fanon, seeking a long range solution, wrote, "We must work out new concepts and try to set afoot a new man."

Those who rely on crime statistics, as does William M. Kephart of the University of Pennsylvania, believe the answer lies in internal controls and calls for a boot strap moral uplift. Overlooking what Dr.

Love told us, one is always dependent on the social and cultural setting, and the assumption that the disenfranchised did not disenfranchise themselves.

Statistics on the victims of crime show that most serious crimes against one's person, aggravated assaults, take place within the victim's own home by someone familiar to the victim. Murder on the street committed by strangers is clearly not in the picture that emerges from these statistics.

There is no discernible group of persons whose personality and behavioral traits predispose it to general criminality.

Ghetto breeds crime

Poverty and the ghetto are the breeders of criminals. The Negro is now the principal prisoner of the ghetto. As W. E. DuBois said in "Dusk of Dawn," "It is difficult to let others see the full psychological meaning of caste segregation. One talks on evenly and logically, but notices that the passing throng does not even turn its head. Some thick sheet of invisible but horribly tangible plate glass is between them and the world. Then the people within may become hysterical. They may scream and hurl themselves against the barriers, hardly realizing in their bewilderment that

they are screaming in a vacuum. They may even, here and there, break through in blood and disfigurement, and find themselves faced by a horrified, implacable and quite overwhelming mob of people frightened for their own very existence."

As Clarke has pointed out, the Negro believes himself to be confined to the low status of the ghetto, and, in fact, usually is.

What the statistics do not reveal is the individual's struggle for self-esteem, his pretense at difference or defiance of his fate, his vulnerability to hurt, his sense of rejection, his fears, his angers, his sense of aloneness.

Rage spills over into violence. Riots are not a Negro prerogative any more than individual crimes are. The early labor riots, in which private industrial, mining and railroad police took the law into their own hands, involved whites on both sides. Historically, three major inter-racial disorders occurred as early as 1917, 1919 and 1921.

In the first of these, which occurred in East St. Louis, whites, inflamed by the heavy influx of "cheap Negro labor" into the area, attacked first. An investigating committee found nine whites and 25 Negroes known dead, but noted that other Negroes had probably died in the fires that resulted from the riots. Property damage amounted to over \$3 million.

The second major race riot occurred after a Negro boy slipped across an unseen Chicago line sep-

Miss Schreiber is an award-winning writer on psychiatry; Herman, the Executive Secretary of the National Association of Private Psychiatric Hospitals.

Ghetto dwellers know another world exists, but they feel they are powerless to escape theirs.

arating the races on the bathing beach at 29th Street and Lake Michigan. After he climbed onto a raft in the white section, rocks were thrown and the boy was drowned. The sequence of recriminations is a bloody tale of riot ending with the death of 15 whites and 23 Negroes.

The third disaster occurred in Tulsa, Okla. A white mob, enraged by the efforts of some Negroes to protect a threatened lynching victim, engaged in a mass assault upon the Negro section, most of which was burned during the course of extended rioting. It is not clear exactly how many persons were killed, but some reports listed 25 whites and 60 Negroes. Property damage was so great that a square-mile area of the Negro section was almost completely destroyed. "Embroidered in such conflicts," Professor Marvin E. Wolfgang maintains, "Negroes have not been entirely peaceable; but down to, and including, the riots of our own day, the injuries inflicted on them by illegal acts of whites have surely exceeded the harm caused by Negro resorts to violence."

Those forced to live in rat-infested tenements see a different life on T.V., and they live in their dreams and hopes in some small part in that T.V. world. They are bombarded by the myths of the American middle class, but they

know their fate is not the common fate of other Americans. There is a powerlessness all Negroes share.

The delinquent sees his only hope in aggressive defiance, even if it is self-destructive. He is rejected and he rejects in turn. As psychiatrist Maurice B. Linden, M.D., director of mental health in Philadelphia, tells us, the Negro youth he worked with in a rehabilitation program often said; "We want someone to want us—if not our mothers, at least the police." Dr. Linden says they sought help, they were eager for it and held out a great deal of promise.

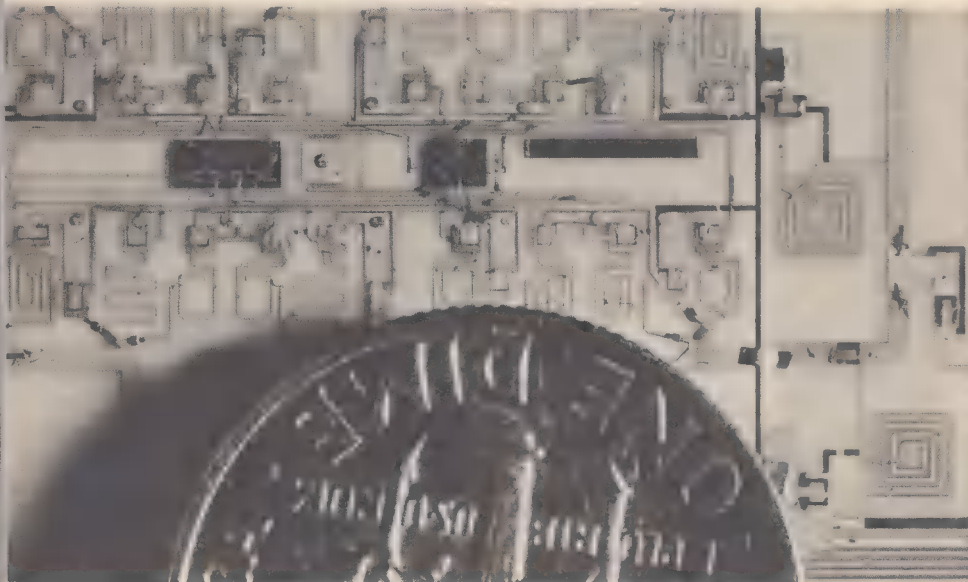
'I have a right to live.'

One Negro drug addict said, "The average young guy I know doesn't have a job. They just don't have anything to do. When you see us down here in Tombs, we're here for robbing and breaking in. Why do we do it? We have to live. I go down to the employment office and I can't get a job. They keep me waiting there all day, but I can't get a job. Still, I have a right to live."

The riots, primitive, angry, vengeful, are a protest against powerlessness.

During periods of Negro protest, Dr. Love says, the cities were free of delinquency which decreased almost to the point of vanishing.

NEW FOR INDUSTRY

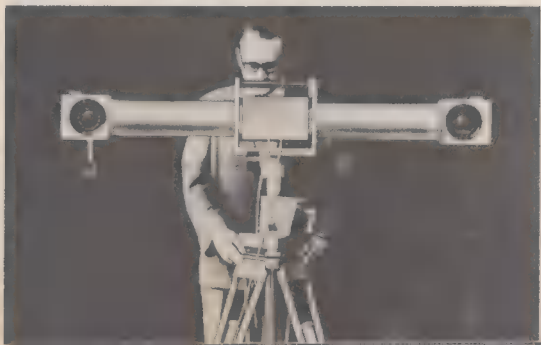


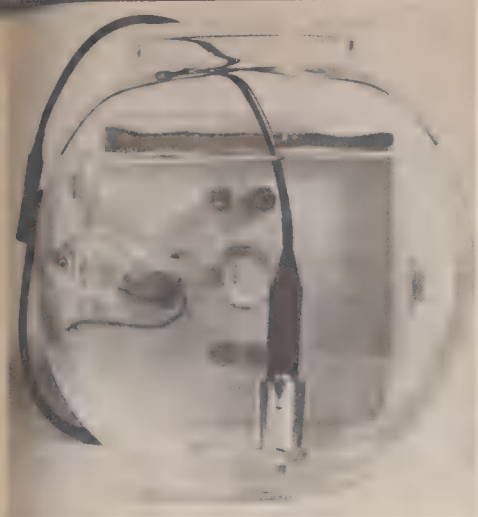
A radar transmitter, receiver and antenna you can hold in your hand has been developed for the Air Force by Texas Instruments, Dallas, Texas. Close-up of the miniature circuit, pictured next to a dime, shows gold paths on which electrons flow. Electronic module eliminates vacuum tubes and motors needed in present radar equipment.



Headlamps that put an end to the "one-eye menace" (cars with one burned out headlight) have been developed by Wagner Electric Corp., Tung-Sol division, Boyertown, Pa. The Guard-Glo lights have safety filament that continues burning when main light burns out.

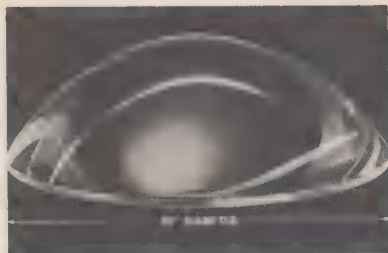
This two-headed camera has an eye for stereoscopic images, and with it, non-measurable objects and processes can be recorded photographically for later evaluation. The camera comes from VEB Carl Zeiss JENA, 69 Jena, Carl-Zeiss-Strasse 1, Deutsche Demokratische Republik





Underwater shock measuring system (above) was developed at Endevco, 801 So. Arroyo Parkway, Pasadena, Calif. The accelerometer system includes sensor, extension cable, electronic module, optionals.

This large aspheric lens (below), 28 inches diameter, 8 inches thick, is first of its kind to be made from acrylic, which gives higher light transmission than glass. By Applied Products Corp., 436 Caredean Road, Horsham, Pa.



New dielectric system (left) for power capacitors comes from G.E.'s Capacitor Dept., Hudson Falls, N.Y. The Magvar system uses synthetic plastic film instead of paper dielectrics, with Pyranol liquid, improving performance.

Rubber water (right) can be obtained by adding TX-150 to the water. The additive changes and controls the property of water, solidifying it to the consistency of rubber. Oil Center Research, Inc., P.O. Box 51871, Lafayette, La.



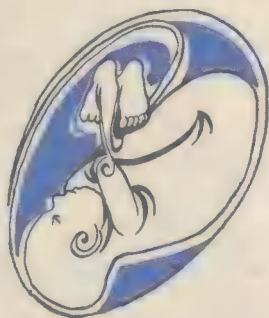
The world's most powerful single-engined diesel electric locomotive made its debut in London. The Hawker Siddeley 4,000-h.p. Kestrel is geared to cruise at 110 m.p.h., with maximum speed of 125. Kestrel represents new generation of railway locomotives for high-speed work where electrification is impracticable. Until this, requirements for 4,000 h.p. could only be met by coupling multiple power trucks or installing two engines in one locomotive.



Drug dangers— the case gets stronger

by Arthur J. Snider

DAMAGING NEW EVIDENCE of the dangers of LSD has been uncovered by the geneticist who first discovered that the drug breaks chromosomes. He has now demonstrated that infants of LSD mothers can be born with impaired chromosomes. Dr. Maimon M. Cohen of the State University of New York, Brooklyn, finds that



LSD penetrates the embryo's blood stream during pregnancy. Eight of 12 infants whose mothers had been exposed to the drug during the first three months of pregnancy were born with increased chromosomal abnormalities.

"The production of congenital defects is therefore a distinct possibility in this group," he says. Malformations have been seen in animals injected with LSD. They

range from stunted growth to nervous system defects. In addition the animals showed a high incidence of spontaneous abortion. Similarly, aborted fetuses in human beings have been found to have chromosomal damage.

The fact that many normal children are born to women taking LSD during pregnancy does not diminish the possibility of birth defects, Dr. Cohen says. It may be that the women were not exposed during a critical time (first three months) of pregnancy.

Because chromosomal breakage is known to be related to cancer, Dr. Cohen continues that there is a possibility that LSD also can produce leukemia and other forms of cancer.

The first evidence that marijuana can cause harm has been presented by Dr. Donald R. Jasinski of the National Institute of Mental Health. He has found that the active ingredient of marijuana, recently isolated, has produced psychotic-like states resembling that produced by LSD.

The pot smoker developed visual hallucinations, distortions of sensory perception, loss of insight, muscle rigidity and muteness.

"He later related that he felt detached from his body, saw himself shrivel down to a doll and wit-

nessed his own funeral," Dr. Jasinski said.

The new evidence conflicts with the widespread impression that no marijuana hazards have been uncovered.

Marijuana's active ingredient, tetrahydrocannabinol (THC), recently has been isolated in pure form.

Commenting on the Jasinski finding, Dr. Joseph H. Skom, chairman of the Illinois State Medical Society on narcotics, said it drives home the potential peril in marijuana.

"Absence of negative evidence hitherto hasn't meant that marijuana is not toxic," he says. "Thali-

domide was used for many years before it was found to be toxic. If users get enough THC in the stuff they are buying, they are facing a hazard. That marijuana users typically have not experienced ■ psychosis indicates that the quantity of THC in reefers is low. But a potential danger is present."

Dr. Harris Isbell of the federal addiction research center, Lexington, Ky., comments that the experiment "definitely indicates the psychotomimetic (psychosis-mimicking) effects of THC are dependent on dosage. A sufficiently high dose can cause psychotic reactions in almost any individual, he emphasizes.

Sleep for the heart

Patients who suffer an acute coronary heart attack are being put to sleep for up to seven days as a means of overcoming pain and fear. They are awakened three times ■ day for feeding, washing and physiotherapy. Purpose of the sleep treatment, devised by two British physicians, is prevention of heart beat irregularity (arrhythmia) and heart stoppage (cardiac arrest).

Pain and mental distress may contribute to death from arrhythmia, the London physicians believe, adding: "Doctors have long known the risk of sudden death in frightened patients."

The sleep regimen has been used in 59 patients, ages 37 to 79. Im-

mediately on arriving at the Charging Cross Hospital, the patients are placed in an intensive care ward and put to sleep with injections of drugs. The drugs also relieve pain. Repeated injections keep the patients asleep, but the dosage is adjusted so that they can be awakened easily three times a day for oral fluids and leg exercises.

Sleep treatment is continued until the patients appear to look well on arousal and free from fatigue, agitation, pain, low blood pressure and circulation impairment. If these signs reappear, the sleep therapy is started again.

Duration of the sleep treatment ranges from a day to a week, with the average 2½ days. At the end of the treatment, patients remain

in the intensive care ward for three to five days.

"The method seems to be safe and practicable," the physicians say. Only one of the 59 patients died in the intensive care unit, but it was because of an ulcer hemorrhage. Eight others died in the hospital after they left the unit. The results were considered good inasmuch as the death rate in coronary heart attacks is usually the highest in the first four days. In Britain, mortality in that period is about 14 percent of all cases.

With typical British whimsy, the doctors add:

"Whether or not further trials support our impression that sleep was a vital part of the regimen, the approach does seem to provide the patient with the most pleasant introduction to a life with cardiac infarction that we know."

Smokers - what kind are you?

Cigarette smokers can be broken down into four classifications, says Dr. Daniel Horn, director of the National Clearinghouse for Smoking and Health. About half indulge for a "positive effect," some 40 percent for a "negative effect," about 10 percent because of habit and 35 percent because of addiction. (Some have puffed their way into more than one category.)

"We now have a simple means of history-taking to diagnose the type of problem each smoker has so that assistance can be designed to meet

the particular one," Dr. Horn adds. He describes each type:

- **Positive effect smoker**—Wants a cigarette when he is most relaxed, such as after a fine meal. Associates smoking with happy and pleasant occasions. Finds it hard not to smoke while enjoying coffee or a



cocktail. Prognosis: A substitute gratification must be found which is either harmless or at least less harmful than cigarettes. This smoker is generally the type who has other pleasurable things in his life and has the easiest time quitting.

- **Negative effect smoker**—Smokes to delay a frightening or unpleasant task. Uses cigarettes as a crutch. Smokes when he feels ill at ease, frustrated or nervous. Finds cigarettes make fear, shame or disgust more bearable. Prognosis: Guarded. The most likely to backslide and begin smoking again at the first sign of a tension situation.

- **Habitual smoker**—Lights up a cigarette when one is already lit. Smokes automatically without thinking about it and without enjoying it. Lights up when he sees

a companion begin puffing. Prognosis: Good. The problem is one of habitbreaking. A tapering-off method or any kind of deconditioning process should offer good prospects of success.

- Addictive smoker—Feels unhappy when he can't smoke in a situation in which he normally would be puffing away. Going without a cigarette after a certain length of time becomes intolerable. Prognosis: Good. Must quit "cold turkey." Cannot stop by tapering off. Although it isn't easy on the nerves, it's effective.

Bloodless knife

University of Utah surgeons are using a new bloodless knife having ionized gas as its cutting edge. Dr. Theodore S. Roberts explains that a radio frequency and argon produce a highly ionized gas that flows through the tip of an insulated hand piece. The tip is only $\frac{1}{7000}$ th of an inch in diameter, but the temperature of the gas is more than 18,000° F. The heat literally vaporizes the moisture in the tissue, leaving a hemorrhage-free incision. Blood vessels are sealed off. The scalpel sterilizes and cauterizes the blood as it cuts. Studies thus far have been limited to animals.

Why our teeth fall out

Nutritional deficiency is more important than inflammation in peri-

odontal disease, the leading cause of tooth loss in adults. This is the view of Dr. Per Henrikson of Cornell University. He points out that most dental authorities believe the teeth in adults are lost because the inflamed gums cause destruction of the bone supporting the teeth. But Dr. Henrikson says the reverse is true. The bone is affected first as a result of poor nutrition.

"If you come right down to it," says Dr. Henrikson, "the average person in the Western world is eating himself right out of his teeth. In other parts of the world, periodontal disease is still more serious. In India for example, it is a major disease of teen-agers since that country has less calcium available for its population than any other country in the world."

The best foods to reduce the



incidence of periodontal disease are milk and milk products because they are high in calcium. Foods poor in calcium and high in phosphorus are meat, meat products and bread, Dr. Henrikson advises.

Periodontal disease is the lead-

ing cause of tooth loss in persons over 34 years old. It accounts for about 65 percent of extractions in adults over 40. An estimated 20 million Americans are toothless or require removal of all their teeth due to advanced periodontal disease.

Why fat people keep eating

When a fat person complains, "Everything I eat turns to fat," most people think it is just a justification for overeating. But the complaint finds a sympathetic ear in the laboratory of Dr. Guy Hollifield, chairman of the Northwestern University department of medicine.

While no one is exempt from the law of conservation of energy—obesity still comes from eating more calories than are expended in energy—the unanswered question is why fat people eat more.

Dr. Hollifield's research suggests there is a metabolic defect in the way the body of the obese individual regulates food intake, and particularly, the way it keeps driving glucose into fat tissue.

The defect may arise through heredity or through injury to the hypothalamus, the organ in the brain having to do with control of hunger and satiety. In many human obese, Dr. Hollifield believes an inherited recessive gene is the culprit. If such a gene is inherited from both parents, it is likely a metabolic error can arise which does not permit the individual to experi-

ence the feeling of satiety.

"It is a curious thing that obese persons have difficulty describing the feeling of satiety, the feeling of fullness or an unwillingness to continue eating food," he explains. "If a slender person partakes of a Thanksgiving dinner, he eventually reaches a point where he feels stuffed. The fat person, however, doesn't reach that point. He stops eating when the food is gone or when everyone deserts the table."

The goal of Dr. Hollifield's research is to find a defect in the metabolic cycle—be it an enzyme, hormone or whatever—and then devise a specific therapy to correct it and enable the obese person to regulate his weight voluntarily. He believes that while there is no single cause of obesity, a metabolic error will one day be found to account for a significant number of cases.

He does not subscribe to the belief that obese people eat to fulfill some emotional need.

"One of the remarkable things about food intake and body weight is that we have no mechanism for excreting excess calories," he points out. "We have marvelous machinery for regulating our water and keeping it at 72 percent of body weight. This is also true for various minerals. If we take in large amounts of salt, we have a perfect mechanism for getting rid of the excess and keeping just what we need. But this is not true as far as food intake is concerned. If you eat it and don't need it, the food is stored as adipose tissue."

That urge to censor

THE INTELLECTUAL who fights censorship of sexual literature may feel like being the censor himself when faced with violence on the television or movie screen.

This paradox has been noted by Assistant Professor Robert A. Corrigan of *The University of Iowa's* American civilization program, who thinks it can teach a lesson to scornful intellectuals.

Corrigan believes the intellectual sees the censor as a stereotyped prudish hypocrite who secretly enjoys films and literature containing sexual material, but who will not admit it to himself or willingly allow others access to the material.

This stereotype is not accurate, Corrigan said. The would-be censor of sexual descriptions probably has had limited education, is alarmed by accounts of sexual behavior which is not part of his own life and is genuinely distressed at the thought that his children may be influenced by alien attitudes, he said.

The same principle holds true with the better-educated intellectual, who may be broad-minded about sexual behavior, but is re-

pelled by violence in films and television shows, Corrigan said.

"The liberal's response to violence is, 'I do not practice it in my own home. I do not beat my wife with a blunt instrument,'" he said. The intellectual rejects "the solving of a personal problem with an act of violence," because it is alien to his daily life—exactly the reason why the man with the eighth-grade education wants to censor sex, but can accept violence by fist or weapon."

The censorship paradox first attracted Corrigan's attention during a three-year stay in Sweden. In Sweden, censors remove the gunplay scenes from Roy Rogers movies, he said, and parents are unwilling to let their children see Walt Disney films showing witches and anthropomorphic trees for fear of traumatic experiences. On the other hand, both movies and magazines are unusually explicit about sex.

The crux of the problem, as Corrigan sees it, is that no overwhelming proof exists as to whether depictions of violent or sexual behavior constitute stimulus toward it or cathartic release of the need.

Safer way to wash water

When the oil tanker Torrey Canyon split open off the coast of

Cornwall, England, and dumped its oil into the sea, detergents were used to help break up the oil slicks. Ultimately, the detergents are be-



A new oil dispersant being tested, COR-EXIT, allows these shrimp to live in treated water, where minute quantities of detergent in water would kill them.

lieved to have done more damage to marine life than the oil itself.

Scientists at the Institute of Marine Science of the *University of Miami*, Fla., have been testing a new product which is harmless to marine life, but still does an effective job in dispersing oil slicks and promoting oil disintegration.

The product, called COREXIT, was developed by the Standard Oil Company, which was so pleased with the outcome of the initial tests that it has begun to carry COR-EXIT aboard its 125 tankers.

In the tests, the mortality of shrimp and fish exposed to COR-EXIT at 10,000 parts per million was not significantly different from those in untreated sea water.

The tests, under the supervision of Dr. Charles E. Lane, professor of marine sciences, found that four

other commercial detergents used for treating oil spills killed the marine life in concentrations as low as 15-30 parts per million.

Shrimp are often used in water pollution experiments, because they are sensitive to and react quickly to any kind of pollutant.

Smoking cuts reflexes

A theory long held by athletic coaches and some doctors that smoking lowers muscle activity has received support from *University of Michigan* researchers.

Two pharmacologists said the smoking of a high-nicotine-content cigarette by a young college student can depress his patellar reflex (knee jerk) up to 67 percent. The depression usually lasts 15 to 30 minutes from the beginning of smoking. Rarely, some subjects showed a depression for as long as 60 minutes.

Drs. Edward F. Domino and Alona M. von Baumgarten found that the depressant effect on the human skeletal motor system seems to be directly related to the nicotine content of the cigarette. Smoking a low-nicotine tobacco lowered the reflex activity about 45 percent and no depression was produced when the students smoked cigarettes containing lettuce leaves and no nicotine.

The researchers found no significant differences between smokers and nonsmokers. In their experiment, involving 45 male students

aged 19 to 29, the knee reflex was elicited automatically every two seconds by a reflex hammer. The reflex action was recorded mechanically by a strain gauge transducer before, during and after smoking. An electromyogram (EMG) of the quadriceps (large thigh) was recorded on a polygraph. Each subject smoked in a series of deep inhaling puffs for four minutes. A second cigarette was smoked 25 minutes after the first. Three cigarettes with varying nicotine content—high, low and none—were used.

Out of this world animal

Without benefit of the high temperatures and pressures required deep in the earth to do a similar job, a primitive little sea creature called a chiton has proved itself a master geochemist by unobtrusively producing four different minerals, including two compounds of iron.

Dr. Heinz Lowenstam, professor of paleoecology at the *California Institute of Technology*, discovered some time ago that these widely distributed mollusks have teeth of magnetic iron, called magnetite.

Further research shows that some varieties also have a second iron mineral in their teeth, lepidocrocite—new as a biologic mineral—plus the phosphate mineral francolite.

Still another mineral which the versatile chiton precipitates is calcium carbonate, found in coral skeletons and shells, and which the

chiton uses for protective shell plates. Thus some chitons precipitate a greater variety of minerals than any animal known.

The chiton, which may be more significant geologically than biologically, ranges in size from microscopic to about nine inches long. The back of each animal is protected by eight calcareous plates that overlap and articulate. The creature is found on rocks along shorelines and down to ocean depths of 13,000 feet, and from the tropics to the polar regions. Chitons have existed on earth for some 500 million years, and they are believed to live 20 years.

The chiton boasts 70 iron-clad teeth in two rows of 35 on a side attached to a tongue-like structure. The iron coating on the teeth is up to three-thousandths of an inch thick. The teeth come in various sizes and shapes.

Chitons are grazers, scraping algae from rocks. The teeth carve away the outer layers of rock, often leaving chevron-shaped gouges in it. The algae are digested and the rock dust excreted.

The rocky diet, which would quickly wear out most teeth, presents no dental problems to the chiton. New teeth are continually being formed on the back of the tongue-like structure, and both rows of teeth gradually move forward as worn-out ones in front are discarded and replaced. The process is a very efficient biological assembly line.

"It looks as if nature experimented with these primitive mollusks and found that the experi-

mentation worked," commented Dr. Lowenstam. "Scientists concerned with life outside the earth might be interested in the mineralization process of the chiton, particularly in those concerned with the different iron oxide materials. It is possible that life somewhere may be based on the iron atom instead of the carbon atom, as is the case on earth."

Charcoal filtered cows

Pesticides have become such a pervasive part of our environment that cows may soon be fed regular doses of charcoal to make sure pesticide residues do not get into milk. And humans might get a similar diet if they accidentally ingest pesticides.

A team of *Michigan State University* scientists reported that they had more than doubled the rate of pesticide removal from cows, sheep, goats and other experimental animals by giving them a charcoal diet.

Scientists know that the pesticide, dieldrin, is recycled from blood and tissues to the gastro-intestinal tract by saliva, bile and pancreatic juice. Knowing this, the Michigan State team sought a compound which would act like glue, sticking to the pesticide residues and allowing them to be carried out in the feces instead of being reabsorbed into blood and tissues.

Charcoal was the answer. It works as an adsorbant, binding itself to pesticide residues and car-

rying them out of the animal's body.

The scientists explained that charcoal is something that cows can readily eat. So can humans. In fact, charcoal tablets have been fed to humans to help cure some liver ailments.

Hot foods shrink fillings

Suddenly developing cavities under old silver fillings? Don't be too quick to blame the dentist or your "sweet tooth," says Dr. Lewis B. Johnson Jr. of *the University of Virginia*. The normal hot foods you put in your mouth every day may be causing the fillings to shrink and let in food particles.

Moderate heat—the temperature of normal hot foods—eventually will reduce the size of the molecules in silver dental fillings, says Dr. Johnson. He notes that, over a period of years, the everyday process of eating hot foods will cause the molecules to shrink permanently, allowing liquid and food particles to leak into the filling cavity.

According to Dr. Johnson, the silver and mercury in dental filling (an alloy of silver, tin and mercury) exist at room temperature as loosely packed cube shaped molecules. However, heat causes them to begin to change into hexagonal, closely-packed units.

The shift from larger to smaller silver-mercury molecules eventually produces a smaller, more porous filling which does not effectively plug the cavity.

Each month Dr. Isaac Asimov chooses one of the questions you send in to answer. He does not make the job easy on himself, for in past months he has written about such things as relativity, parity and the basic nature of light. Following Dr. Asimov's answer are the answers to some of your other questions written by regular members of the Science Digest staff.

Birth of the oceans



How and when were the oceans formed?

In the early part of the 20th century, it was thought that the earth and the other planets were formed of matter pulled out of the sun. We had the picture of an earth gradually cooling down from white heat, to red heat, to mere hotness and finally to the boiling point of water. When it had gotten cool enough for water to condense, the water vapor in earth's heated atmosphere did so and it began to rain and rain—and rain. After many years of an incredible rain of boiling water that fizzed and sputtered as it struck the hot earth, the hollows of the planet's rough surface finally cooled enough to hold the water and filled up to form our oceans.

Very dramatic—but almost certainly completely wrong.

Currently, scientists are con-

vinced the earth and the other planets did not form from the sun, but were formed of particles coming together at the same time that the sun itself was being formed. The earth was never at sun temperature, but it did grow quite warm through the energies of collision of all the particles that formed it. It grew warm enough so that its relatively small mass could not hold an atmosphere or water vapor to begin with.

The solid body of the newly-formed earth had, in other words, neither atmosphere nor ocean. Where, then, did they come from?

There existed water (and gases) in loose combination with the rocky substances making up the solid portion of the globe. As that solid portion packed together more and more tightly under the pull of gravity, its interior grew hotter and hotter. Water vapor and gas were

forced out of combination with the rock and came fizzing from its substance.

The gaseous bubbles, forming and collecting, racked the baby-earth with enormous quakes; escaping heat produced violent volcanic eruptions. For unnumbered years, liquid water did *not* fall from the sky; rather, water vapor whistled out of the crust and then condensed. The oceans formed from below, not from above.

What geologists mainly dispute now is the rate at which the oceans formed. Did the water vapor all fizz out within a billion years or less, so that the ocean has been its present size ever since life began? Or has the process been so slow that the ocean has been growing all through geologic time and is still growing?

Those who maintain the ocean formed early in the game and has been steady in size for a long time, point out that the continents seem

to be a permanent feature of the earth. They do not seem to have been much larger in the past when the ocean was, supposedly, much smaller.

On the other hand, those who maintain the ocean has been growing steadily point out that volcanic eruptions even today pour quantities of water vapor into the air; water vapor derived from deep-lying rocks, not from the ocean. Also there are sea mounts under the Pacific with flat tops that may have once been at ocean level but are now hundreds of feet below.

A compromise may be possible. It is suggested that the ocean has indeed been growing steadily, but that as the quantity of water increased, its weight forced the ocean bed downward. In short, the oceans have been growing steadily deeper, not broader. This would account for both the drowned sea mounts and the non-drowned continents.

—Isaac Asimov

What is a slime mold?

It is hard to know whether to describe the slime mold as an individual or a group. One type of slime mold, *Dictyostelium discoideum*, begins life as a group of individual amoebas. They move about having no apparent connection with one another, looking like soil amoebas.

After a day or two of independent life, a change comes over these amoebas. They decrease in size

and become elongated. Then they group about a few amoebas.

Says Helena Curtis in her new book "The Marvelous Animals: an Introduction to the Protozoa" (Natural History Press), "The 'beast' that the swarming amoebas turn into (although it is much smaller) very closely resembles a common garden slug, and it moves along slug-fashion with a small pointed 'head' or apex and a broader base, leaving behind a track of slime.

The 'slug' is actually not a single animal but a mass of individual amoebas all stuck together, but all vigorously moving their pseudopods, even the ones in the center of the sausage-shaped mass. The slime around them is a thin sheath, a sort of tunnel secreted by the amoebas through which they crawl, then leave behind them."

The "slug" moves along anywhere from a few hours to a couple of weeks until it finds a spot that is warm and open. Then another remarkable change takes place. The front end stops moving and the rear cells bunch up behind it. The result looks like a little blob with a tip on it. A base forms beneath the blob. Some of the cells begin to manufacture a cellulose like product which forms a cylinder. The cylinder grows into a stalk between the base and the blob. Other cells move to the top and form hard protective coats about themselves.

Writes Mrs. Curtis: "The spore cells in their little shimmering drop of mucilage are at the very pinnacle of the stalk. The drop contains some 85 percent of the original mass, with only about 15 percent sacrificed to the goal of raising the spores where they can be dispersed through the new territory found by the migrating sausage. Once these spores fall onto the warm damp ground, each will hatch a new small amoeba, indistinguishable from other soil amoebas, but each containing coded within it the entire information for this whole remarkable sequence of events."

How Fast Can You Read?

A noted publisher in Chicago reports there is a simple technique of rapid reading which should enable you to double your reading speed and yet retain much more. Most people do not realize how much they could increase their pleasure, success and income by reading faster and more accurately.

According to this publisher, many people, regardless of their present reading skill, can use this simple technique to improve their reading ability to a remarkable degree. Whether reading stories, books, technical matter, it becomes possible to read sentences at a glance and entire pages in seconds with this method.

To acquaint the readers of this publication with the easy-to-follow rules for developing rapid reading skill, the company has printed full details of its interesting self-training method in a new booklet, "How to Read Faster and Retain More" mailed free to anybody who requests it. No obligation. Send your name, address and zip code to: Reading, 835 Diversey Parkway, Dept. 690-017, Chicago, Ill. 60614. A postcard will do.



K.F.S.

Do you remember when the only plastic around was in the President's stiff collar?

The celluloid collar and other plastics

by John and Molly Daugherty

AN ESTIMATED one billion pounds of plastics will go into the 1969 model of American automobiles. This is 110 pounds a car. In the 1967 models, the amount was only 59 pounds a car. By 1975, the projection is 156 pounds of plastics a car.

The use of modern plastics is increasing rapidly.

What do you know about plastics?

1. A natural plastic used in medieval times was
 - a. Casein

- b. Sealing wax
 - c. Celluloid

2. The first highly successful synthetic plastic, developed in 1909, was
 - a. Bakelite
 - b. Rubber
 - c. Vinyl
3. Plastics which do not lose their potential plasticity in the finished product are
 - a. Thermoplastic
 - b. Thermosetting
 - c. Cold moulded
4. Latex—raw rubber—is thermoplastic. Vulcanizing it with sulfur and heat
 - a. Increases its plasticity
 - b. Destroys its elasticity
 - c. Causes it to set in the mould
5. The plastic widely used today in auto-

mobile safety glass is

- a. Celluloid
- b. Cellulose acetate
- c. Polyvinyl butyral

6. Casein, discovered in 1897, is made from the protein in milk and cured in a solution of formaldehyde. One property of casein (actually a weakness among plastics) enables the mass production of buttons by stamping. This property is

- a. High water absorption
- b. Poor electrical insulation
- c. Poor resistance to decomposition by heat

7. Production of ping-pong balls from celluloid uses the method of

- a. Extrusion moulding
- b. Blow moulding
- c. Injection moulding

8. The key to the rapid development of the modern plastics industry started in 1924 with

- a. Nylon made from coal, water and air
- b. Phenolic plastic moulding powders
- c. The development of new plasticizers

9. Nylon is a thermoplastic of a class of polymers called polyamides. Numbers designate the different kinds of nylons. The numbers refer to the number of carbon atoms in the interacting chemicals, the diamine and the specific acid. Single numbers refer to the number of carbon atoms in the molecules of the end product. The original and most widely used nylon for moulding purposes is nylon

- a. 6:6
- b. 6:10
- c. 11

10. One of the modern plastics discovered in Britain during World War II is

- a. Acetal resins
- b. Silicone polymers
- c. Dacron (or terylene)

Answers:

1—b Sealing wax. In medieval times sealing wax combined beeswax, Venetian turpentine and a pigment. The plasticity of the heated wax permitted impressions to be stamped on the articles of the Magna Carta of 1215, still to be seen in the British Museum. Later the Venetians substituted lac from the East Indies for beeswax. Lac is the resin used in making shellac.

2—a Bakelite. Dr. Leo Baekeland, using the chemical phenol from coal tar and formaldehyde, produced a plastic resinous substance. He published the results in 1909. The resin softened when heated, but with continued heating in the mould it set into a solid which was permanent.

The chemical change built a polymer of long molecules from the smaller molecules of the phenol and formaldehyde.

3—a Thermoplastic. These materials become soft and plastic when heated, but at normal temperatures they become hard and rigid. They are *not* permanently hard; they become plastic again when heated.

Thermosetting plastics, when heated to plasticity and moulded, become permanently set with continued heating. No further reversal to the plastic condition is possible. Cold moulded plastics which have plasticity at normal temperature may go through a chemical change and harden without heating.

4—c Causes it to set in the mould. Vulcanizing converts rubber to a thermosetting plastic. After setting, the rubber no longer has plasticity,

but the property of *elasticity* still remains except when hard rubber is produced by the use of extra sulfur and additional heating in the vulcanizing process.

5—c Polyvinyl butyral. Safety glass has an inner layer of plastic. If the glass breaks, the smaller pieces stick to the tough plastic. Light does not cause deterioration of polyvinyl butyral, and the edges of the glass need no sealing to protect it. Its impact strength is excellent, especially at low temperature, where polyvinyl butyral's resistance to impact may be six times greater than cellulose acetate. Cellulose acetate, however, was a big improvement over celluloid used in the early cars. Celluloid discolored badly and even blistered in the presence of light.

6—a High water absorption. Water added to the casein extracted from milk develops its plasticity. After fabrication of the product, the casein is cured by soaking in a formaldehyde solution which increases its resistance to water, but *not* completely. Discs of the plastic cut from rods can be *stamped* into buttons. A button can absorb 25 percent of its weight in water unless further treatment with alum to harden it takes place.

7—b Blow moulding. The mould consists of two blocks hinged along one edge, each block having a hole in the center the size of one-half of a ping-pong ball. Two sheets of softened celluloid with a hollow needle between them are placed between the blocks. When air is forced through the needle to the center, it

pushes the thin celluloid to the outer surface of mould. After removing the needle and cooling the material, the blocks are opened and excess plastic around the seam is cut away.

8—b Phenolic plastic moulding powders. Prepared powders (or pellets) of the plastic material saved the time of weighing out all the separate components of plastic, formaldehyde, fillers and pigments. Moulding powders, once in the mould, could be quickly pressure-moulded—important in mass production.

9—a 6:6 There are 6 carbon atoms in the hexamethylene diamine molecule and 6 carbon atoms in the adipic (dibasic) acid which produce nylon polyamide. This nylon has a high melting point of 482°F. Nylon 6:10 has a lower melting point. Nylon 11 has 11 carbon atoms in the molecule of the end-product made from 11 amino-undecanoic acid by self-condensation.

10—c Dacron (or Tervlene). This is a thermoset plastic which does not soften when heated after setting. After the discovery of polyamides like nylon, polyesters were developed by the interaction of alcohol and an acid to set free water and give an ester. The long threadlike molecule is a polyester. Dacron is the polyester polyethylene terephthate.

Score yourself:

9—10 right—Excellent

4—8 right—Good

0—3 right—Fair

Battles of the bones

Before the Deluge, by Herbert Wendt, translated by Richard and Clara Winston. Doubleday (\$6.95).

Excitement in science can be found in the most unpromising places. Take paleontology, the study of fossils, for example. Why the word practically smells of dust. But as German science popularizer Herbert Wendt shows, in his thorough and entertaining "Before the Deluge," paleontology has a real blood and guts history. Scandal, intrigue, bribery, vicious vendettas, everything short of murder, can be found in the story of this "dusty" science.

Highpoints of the book are the author's descriptions of the great confrontations between scientists: Cuvier against Lamarck, Darwin and Huxley against Owen and Agassiz, and the "Battle of the Bones" between Edward Drinker Cope and Othniel Charles Marsh.

These battles were rarely conducted with scholarly dignity. Cuvier burst into Lamarck's lecture room and shouted, "Such a wild claim could only be made by someone who is blind—blind to the facts of Nature." Of course Cuvier well knew that his aging rival had recently become blind and had to be led into the lecture room by his daughter.

Darwin had no stomach for controversy, but his friend and follower Thomas Henry Huxley relished it. In a famous debate, Huxley ver-

bally battered the life out of the spokesman for the anti-evolutionists, the Bishop of Oxford "Soapy Sam" Wilberforce. The Bishop had been coached by Darwin's most learned scientific enemy, Robert Owen, but he was unable to stand his ground against Huxley's onslaught, and was reduced to a feeble attempt at ridicule: "If you truly believe that you are descended from an ape," he challenged Huxley, "it would interest me to know whether the ape in question was on your grandfather's or your grandmother's side."

Ridicule has no place in scientific debate, or if it does get in, it at least should be sharp. "Soapy Sam" left himself wide open for Huxley's icy reply:

"If you ask me whether I would prefer to have a wretched ape for my grandfather or a brilliant man of great importance and influence who uses his gifts to make mock of a serious scientific discussion, then I unhesitatingly declare that I prefer the ape."

But for sheer meanness, nothing quite matched the feud between America's two leading paleontologists, Cope and Marsh.

They stole one another's fossils, plagiarised each other's research. Each accused the other of stupidity, fraud, misappropriation of funds and anything else they could think of. The whole thing finally wound up in the courts, and in Congress,

which had been granting large sums of money for paleontological research.

Writes Wendt, "By this time, most of the senators were thoroughly sick of the scandal. In any case they had no idea what paleontology was good for. Consequently they arrived at a verdict that struck both scientists hard. Public monies had been scandalously wasted on the excavation of useless old bones,

they declared; all such expenditures must stop. . ."

It is sidelights like these that give "Before the Deluge" its real appeal. Of course, it also gives you ■ good grounding in paleontology, but lots of books can do that, if for one reason or another you are forced to read them. "Before the Deluge" is the sort of book you want to read, not the sort you have to read.—DC

Other new books of interest

A Paradise of Birds. Helen Gere Cruickshank. Dodd, Mead. (\$7.50). The world of bird watching becomes very exciting, even to the nonbird watcher. The author not only describes the large variety of birds she and her photographer husband have seen on various spring visits to Texas, but she vividly depicts the changing countryside and even adds some notes on the colorful history of the state.

Flashing Wings. John K. Terres. Doubleday. (\$4.95). Another book about birds, only this one deals with both the beauty and grace of birds and the technical aspects of their flight—how high they can go, how fast they can go, how they learn to fly, etc. The book also contains detailed appendices on bird sizes, terms and scientific names.

Men Who Dig Up History. Lynn and Gray Poole. Dodd, Mead.

(\$4.00). Archaeology is a science that deals with much more than hunting for buried treasure. It is hunting for clues to man's past. It is certainly a fascinating field, and the lives of 10 scientists known for their achievements in the field make interesting reading.

High Energy Physics. Hal Hellman. J. B. Lippincott Co. (\$4.75). High energy physics is largely the study of the "fundamental" or subnuclear particles that have been created in "atom smashing". It is a fairly new area of study in physics, having been separated from nuclear physics in just the last 15 years. Mr. Hellman presents an easy to understand account of this area of science and the developments in high energy physics, supplemented with numerous charts, photographs and drawings to illustrate the text.

The Lovely and the Wild. Louise de Kiriline Lawrence. McGraw-Hill. (\$6.95) From childhood, the author

dreamed of living in an unspoiled spot close to the real beauties of nature. This is the story of her dream come true and the birds and animals she has come to know and revere in her forest world of Ontario, Canada.

Southern Seashores. William M. Stephens. Holiday House. (\$3.95). This marine biologist has written an enlightening book on the fascinating creatures and plants that exist in Southern waters. The illustrations include some unique pictures, such as that of a tiny and

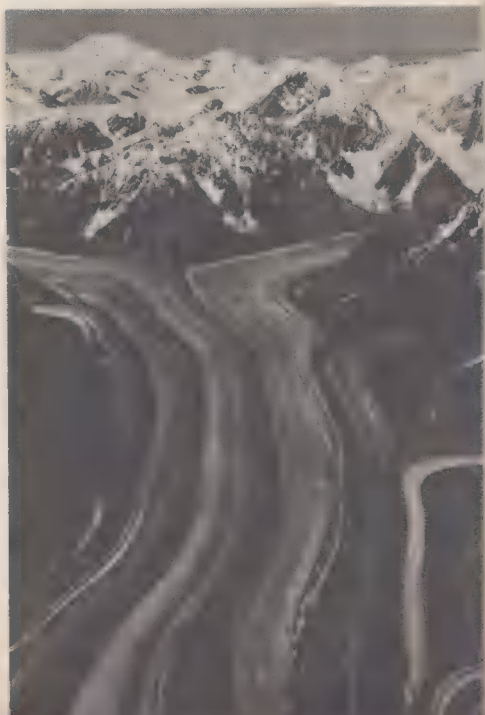
rarely seen deep sea squid that is a descendant of shelled cephalopods that existed 300,000,000 years ago.

Unusual Aquarium Fishes. Alan Mark Fletcher. J. B. Lippincott. (\$4.50). The 35 fishes (the plural of one kind of living fish is fish, but the plural of more than one species is fishes) the author describes and illustrates are unusual not for their rarity in numbers, but for certain unique characteristics. Many are actually quite common and can be raised in most aquariums.

Exploring our natural wonders

The Forging of Our Continent. Charlton Ogburn Jr. American Heritage Publishing Co. (\$4.95).

This beautifully put together book is richly endowed with pictures of America's natural wonders, such as the fascinating pattern of moraines (accumulations of earth and stones) deposited by the Barnard Glacier in Alaska, shown here. It is written for the layman who wants to know what lies beneath the surface, and just how it all came about. Thorough appendices and glossaries are included, quite naturally so since the book is published in collaboration with the Smithsonian Institution. And contrary to most books of this nature and slick appearance, it is not overpriced.



INVENTIONS

Idea of the Month

Get hot with COED

PROJECT COED at Princeton, N.J., is educational in one sense—it is aimed at teaching American industry better ways of using this country's bituminous coal deposits.

The name is an acronym for char oil energy development, and the project has been carried on since 1962 at the chemical research and development center of the FMC Corporation under a contract with the Office of Coal Research of the Department of the Interior.

Dr. R. Tracy Eddinger, Dr. John F. Jones and Leonard Seglin, chemical engineers at the center, were recently granted Patent 3,375,175 for a heat treatment process that may be carried on at remote mine sites. It produces synthetic crude oil, gas and a char with low sulphur content.

The char is a burnable powder suitable for generating electric power; part of it can be consumed in producing heat for the process. Its low sulphur content reduces air pollution.

At the mine site the gas can be converted to hydrogen, for ammonia plants or petroleum refineries, or to a gas for general use



Leonard Seglin, Dr. R. Tracy Eddinger and Dr. John F. Jones (left to right) are inventors of new coal processing method.

such as home heating. The oil and gas can be moved by pipeline.

Some huge coal deposits, according to the patent, can be mined inexpensively, but have little commercial value because of shipping costs.

The director of the Office of Coal Research, George Fumich Jr., said recently that he considered Coed "one of our better projects."

The patented process includes heating finely divided coal in at least three beds at progressively higher temperatures. The beds are "fluidized" by passing heated gases through them. The method is aimed at a maximum oil yield.

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—Stacy V. Jones

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More pyramids from Mayans

In your April '68 issue (The pyramids of Kush), you said that the ancient inhabitants of Kush built more pyramids than anyone else—over 230. Well, you're wrong. In Mexico, there are over 100,000 pyramids, of which over 250 were built by the Toltecs, and in Uxmal and Chichen Itza alone there are over 300 pyramids. Both of these cities were built by the Mayans. The Mayans built a total of over 2,000 pyramids.

CHUCK FULDA
Kansas City, Mo.

Author's Reply:

I think it's a matter of how you define "pyramids." I had in mind large structures like those of Giza, or the two big ones at Teotihuacán, or those of Meroë. If you count all the roughly pyramidal structures built as cenotaphs, altars, dance platforms, etc., the number in all these countries can be increased astronomically. In Egypt, from the 17th dynasty on, hundreds of tombs surmounted by small brick pyramids were built for members of the upper classes; remains of these have been found at Abydos and Deir el-Medina. But if we only count large pyramids, I have seen most of the big Mexican ones,

and there certainly weren't any 100,000 of them.

L. SPRAGUE DE CAMP
Villanova, Pa.

The cigarette addict

In your column on psychiatry in the March '68 issue (page 68), Dr. Marcovitz tries one more theory to explain cigarette addiction as something purely mental. If he was right that I only inhale to define my inner space to my sub-conscious mind, then I would switch to smoking grass tomorrow. It is cheaper and would do all the things which the doctor claims tobacco does.

He ignores two basic facts. No tribe in history has ever become addicted to any smoke which did not contain nicotine. No tribe which has had access to tobacco in any form has failed to become addicted to it.

If only someone would admit that nicotine causes a physical addiction, then maybe they could find a way to cure it or satisfy it in a less harmful manner.

E. MARQUIS
North Bay, Ontario

See page 64 for a new look at cigarette addiction, the different classifications of cigarette smokers and which ones have the best chances of breaking the habit. —Ed.

'Extinct' hutia like guinea pig

I was fascinated to read your article, "This is an extinct animal," in the March '68 issue. The hutia looks so much like a guinea pig that I am curious to know whether it's possible to breed a hutia and guinea pig. From the picture they appear tail-

less, with three back feet toes. I assume they may have four on the front if closely related to guineas.

Perhaps you could tell me something about an ancestral relative to the guinea pig, if such exists, since the guinea has changed slightly through domestication. Do you know if hutias squeal and whistle like guineas?

PHOEBE PERKINS
Chester, Pa.

Although it isn't apparent in our photograph, hutias do have a tail similar to a rat in some species and prehensile in others. One species has five claws on each foot, and the hutia's sounds include teeth chattering and shrill whistling. Hutias and guinea pigs belong to different families, so it is unlikely they could be bred. Little is known about ancestors of the guinea pig, except that they have been found as far back as the middle Miocene period.—Ed.

Regarding the hutia

It was interesting to read that the Plana Cay hutia ("This Is an Extinct Animal," March '68) belongs to an "extinct" species. As you do not mention the technical name, it is not possible to comment further on this point. The hutias are exclusively Antillean and many species have disappeared due to the destructive presence of man.

It may be of interest to some of your readers to know that the hutia was the "mohuy" that Gonzalo Fernandez de Oviedo mentioned as "the food that the caciques and chiefs of this island (Santo Domingo) valued and appreciated most." This was probably the *Brotomys contractus*

which is now believed extinct. It could also have been *Plagiodontia* or *Isolobadon*. Of 18 known species of Capromyids (the hutia family), nine are extinct, seven are living and rare and one is of doubtful status. One species of hutia, *Plagiodontia hyalaemum*, of Santo Domingo, is still living, though it is now also rare.

AMBROSIO MALAGON
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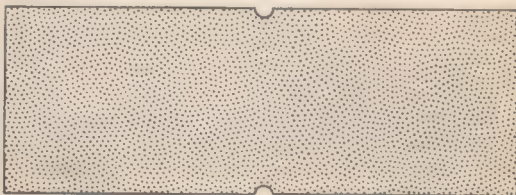
in reducing the temptations to remove our organs prematurely for use in transplants. We affirm by legal instruments that we do not want any of our organs removed since we have hope of again needing them in the event of the future resuscitation. Some biologists feel that the ultimate solution to the organ supply problem after transplants from humans and animals and implants of prostheses will be to grow organs in culture using the individual's own genetic instructions.

FORREST WALTERS
Latrobe, Penn.

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January through June, 1968

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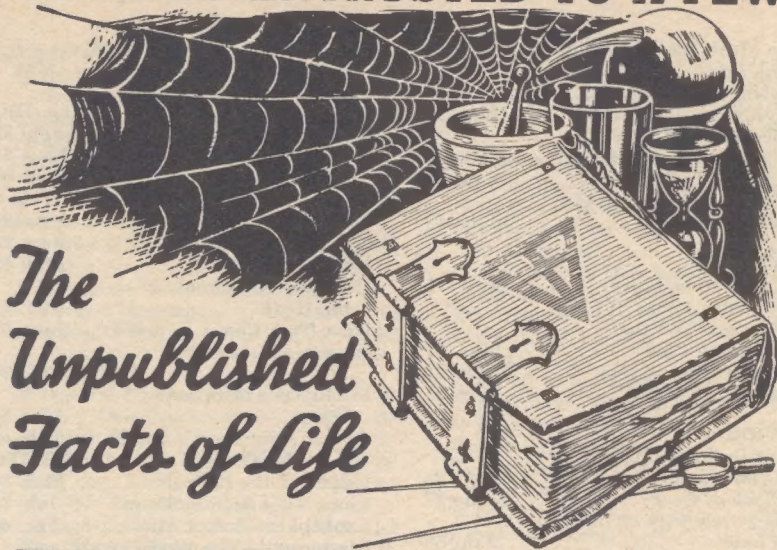
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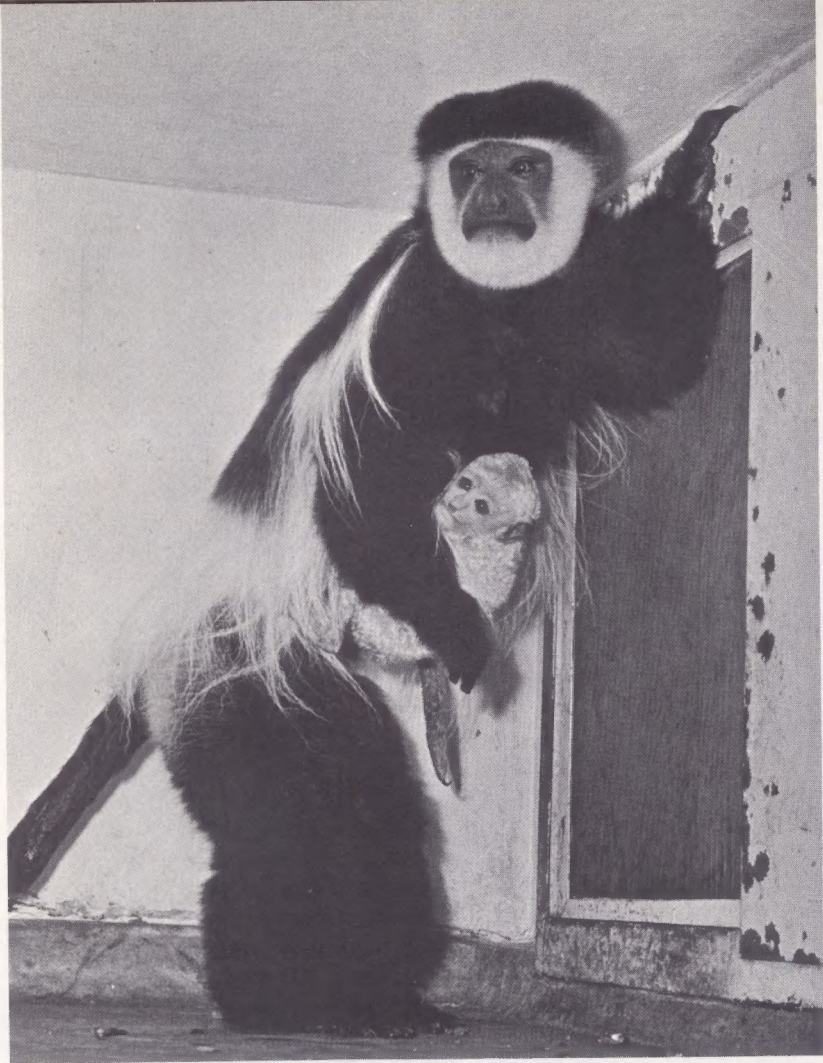
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Pictorial Parade

The impossible baby

THEY SAID it couldn't be done, but this mother and clinging baby are proof that it can be. Until this baby Guereza ape was born at the Berlin Zoo last year, it had been impossible to breed the apes in cap-

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ELECTRICAL LAB

All the equipment for basic electrical experiments with Wheatstone Bridge (measures resistance), Magnetizer and De-magnetizer, Thermocouple, Mystery Shock Box, Continuity Tester, Induction Voltmeter, Selsynoid Coin Toss, Electromagnetic Relay, Neon Lamp, Galvanometer, Induction Coil, Resistors, Chemicals and Electrodes for Plating and Electrolysis. FOR SAFETY a step-down Isolation Transformer provides required current.



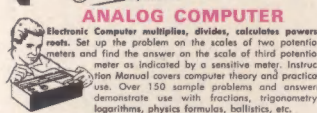
STROBE LIGHT

A Neon Lamp that flashes at intervals you can synchronize with the speed of rotating or vibrating objects in order to "freeze" their motion to permit close study and checking frequencies and RPM. Flashes are timed by a variable frequency oscillator with a range of 20 to 600 cycles per second.



PHOTOELECTRIC RELAY

Crystal PhotoCell, Electronic Amplifier, Relay, large Condensing Lens in Cabinet Mount. Features automatic on-off or holding circuit operation. Sensitivity Control, Plug-in Outlet for controlled circuit. Use for alarms, counters, etc. Operates on 115V AC. A basic unit for many exciting experiments.



ANALOG COMPUTER

Electronic Computer multiplies, divides, calculates powers, roots. Set up the problem on the scales of two potentiometers and find the answer on the scale of third potentiometer as indicated by a sensitive meter. Instruction Manual covers computer theory and practical use. Over 150 sample problems and answers demonstrate use with fractions, trigonometry, logarithms, physics formulas, ballistics, etc.

LIGHT AND OPTICS LAB

Exciting optical projects for the study of light. Equipment includes five Precision Lenses, Prism, Polarizing Filters, Diffraction Grating, Mirror, Telescope Tubing, Lens Mounts, Tube Holders and Brackets. All the parts and instructions to build a Camera Obscura, Camera Lucida, Polariscopes, and many other optical devices.



PHOTOGRAPHY LAB

A PRECISION 35MM ENLARGER... horizontal type with twin condensing lenses and 2" f/11 projection lens. Produces quality enlargements up to 3 1/2" x 4 1/2". Contact Print Frame takes negatives up to 3 1/2" x 4 1/2". 3 Plastic Developing Trays, Neon Safelight, Thermometer, Film Clips, Developing Chemicals, Printing and Enlarging Paper and Darkroom Handbook. Make quality enlargements for 6¢. Make prints for only 2¢. Full instructions included.



RADIO LAB AND COURSE

YOU BUILD A SHORTWAVE AND BROADCAST RADIO. 3-tube regenerative circuit. Uses 115V AC. CARBON MICROPHONE with AUDIO AMPLIFIER. RADIO TRANSMITTER for code or voice. RIFLE TANK WAVE GENERATOR with variable frequency. Invaluable in the understanding of wave theory. CODE PRACTICE OSCILLATOR with manual. "Steps to a Ham License." All you need to pass the FCC Ham License Exam.



RADIO SERVICE TOOLS

SIGNAL TRACER. A valuable trouble finding tool which permits you to "listen in" as you probe through a faulty circuit until you find the trouble spot. CONTINUITY TESTER. Pin-points open circuits and test voltages. The use of both pieces fully described in accompanying manual. "Simplified Radio and TV Servicing."



DC POWER SUPPLY

Changes regular 110-120V AC to the direct current required for electronic projects and experimenting. Consists of a Power Transformer, Vacuum Tube Rectifier, 20/20 MFD Capacitor Filter Circuit, and a potentiometer Voltage Selector. A Safe Isolated Power Supply eliminates the need of expensive multi-volt batteries.

MICROCRAFT LAB

Microprojector shows microscopic subjects enlarged with brilliant detail on wall or screen. Has sturdy Steel Cabinet, large Condensing Lenses for extra brightness, and a GE Projection Lamp. Microscope features Ramsden Eye-piece for wide field viewing, Substage Light and Polarizing Filter. Magnifies up to 200X. Includes: Slides, Cover Glasses and Microscopy Manual.



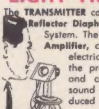
PHOTOMICROGRAPHY CAMERA

Photographs subjects mounted on microscopic slides. Enlarges up to 100X. Takes clear, sharp pictures of specimens too small to be seen with the naked eye. A fully self-contained unit—no microscope required. Uses standard roll film, either 120 or 35, black and white or color. Make a photographic record of your projects with microscopic subjects.



LIGHT TRANSMITTER-RECEIVER

THE TRANSMITTER consists of a Light Source, a Modulating Reflector Diagram and an Optical Projection System. THE RECEIVER is a Two-Stage Audio Amplifier, controlled by a Photo-electric Cell that catches the projected light beam and causes the original sound wave to be reproduced in the headphones.



ATOMIC ENERGY LAB

ATOMIC CLOUD CHAMBER WITH PROJECTOR ILLUMINATOR. See the vapor trails of alpha and beta particles, and of cosmic rays. SPINTHARISCOPES. Shows exploding atoms. ELECTROSCOPE—metal housed with Scale and Magnifying Viewer. Measures background radiation and tests samples. SAFE RADIOACTIVE MATERIALS. Alpha Source in handy container and Uranium Ore. Full instructions and explanations open up the fascinating field of nuclear physics.



SPECTROSCOPE

Analyze the spectra of glowing gases. See and identify the Fraunhofer Lines. A quality instrument featuring an easy-to-read built-in scale and a powerful condensing system for a bright spectrum. Equipment includes Alcohol Burner and a 2 Watt Neon Spectral Lamp. Full instructions cover theory and use.



ULTRAVIOLET LAMP

140 watt filter type UV LAMP. Heavy metal cabinet 6 foot Cord, Rotary Switch. Produces dazzling cold effects with invisible black light. Has many uses in the fields of Mineralogy, Crime Detection and Science. Accessories include Invisible Ink, Tracer Pen, Fluorescent Crayons.



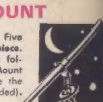
SURVEYOR'S TRANSIT

A practical Transit. 6X erect image telescope with Range Finder. Reticule for measuring remote distance and heights. Vernier reading for both horizontal and vertical scales. Leveling Head with Thumb Screw Adjustment and Spiral Level. Clamps under head hold wooden legs of Tripod. (Legs not included.) Instructions cover elementary surveying, range-finding.



TELESCOPE AND MOUNT

30X erect image. Extends to 30" length. Five ground and polished lenses. Ramsden Eyepiece. Sturdy Equatorial Mount makes it easy to follow the movement of heavenly bodies. Mount has fittings for wooden legs that complete the tripod (legs are regular 1x2 lumber not included).



WEATHER STATION

A REMOTE READING ANEMOMETER AND WIND-VANE... Flashing Neon Lights on indoor indicator board show wind speed and direction. Operates on less than 1 cent per month. Safety Power Cord makes all connections safe. 100 ft. of Lead-in Wire. Plus—Air Tank Barometer with 4 ft. indicator column. Sling Psychrometer measures relative humidity. Rain Gauge measures rainfall to 1/100 inch. ALSO Cloud Chart, Weather Map and Forecasting Manual—a complete set-up for amateur meteorology.



You get ALL the equipment for ALL the above in nine monthly kits

SEND \$1.00 ONLY TO ENROLL PAY \$4.75 FOR EACH KIT THAT YOU RECEIVE

Take as few as you wish—or get all nine... it's up to you!

SOME QUESTIONS ANSWERED

- Q. How is it possible? It seems incredible to be able to get all the equipment shown above in just nine kits—at only \$4.75 per kit!
- A. The low overhead of the membership plan is just part of the answer. The real key to this amazing program is ABC's Club's especially designed multi-use equipment. For example: The Microprojector quickly and easily converts into the Spectroscope, Photo Enlarger and Cloud Chamber Illuminator. Similarly, the Transit Head doubles as a Telescope Mount. Such multi-purpose design makes possible this all-science program at a price everyone can afford.
- Q. May members choose the order in which they receive their kits?
- A. Yes. With the first kit members receive a list of the equipment and projects contained in each of the remaining eight kits. With this information they are able to choose the kit sequence that best suits their particular interest.
- Q. Can members get their kits all at once instead of one-a-month?
- A. Yes. At any time members can have the balance of their kits sent in one shipment. We recommend that you start on the kit-a-month plan because the monthly spacing will give you time to get the full measure of knowledge and enjoyment that each kit has to offer.

NO OBLIGATION—NO RISK!

- ★ You take only as many kits as you wish.
- ★ All kits on 2 weeks approval.
- ★ You may return any kit for full refund.

Send coupon today—get your first kit on its way!

TRIAL MEMBERSHIP COUPON

I wish to try the Kit-a-Month Program:

- ☐ I enclose \$1.00 to enroll and \$4.75 for the first kit postpaid.
☐ I enclose \$1.00 to enroll. Send first kit COD. I'll pay COD fee.

I understand if I am not satisfied with the first kit I may return it for a complete refund including the \$1.00 membership fee.

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